

ANTALYA BELEK ÜNİVERSİTESİ YAYINLARI

Antalya Belek Üniversitesi Yayınları, Antalya
YAYIN NO: 02
e-ISBN: 978-625-99637-1-6
Publication Date: November 30, 2023

3DPRINT TURKEY
PLATFORM

7th International Congress on 3D Printing (Additive Manufacturing) Technologies and Digital Industry 2023 (3D-PTC2023)

Editorial Board

Dr. Binnur SAĞBAŞ
Dr. Kerim ÇETİNKAYA
Dr. Cem Bülent ÜSTÜNDAĞ
Dr. Koray ÖZSOY
Dr. Burhan DUMAN

ABSTRACT PROCEEDINGS

ISBN: 978-625-99637-1-6

THE RESPONSIBILITY OF THE WORKS IN THE BOOK OF THESE PAPERS BELONGS TO THE AUTHORS.

THE CONGRESS HAS PARTICIPANTS FROM AT LEAST FIVE DIFFERENT COUNTRIES.

PARTICIPANT COUNTRIES



ORGANIZER UNIVERSITIES

SUPPORTING INSTITUTIONS









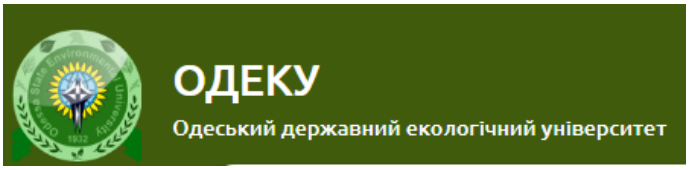












COMMITTEES

HONOUR COMMITTEE
Prof. Tamer YILMAZ, Yıldız Technical University, TR

GENERAL CHAIR
Prof. Kerim ÇETİNKAYA, Antalya Belek University, TR

CHAIR(s) OF CONGRESS
Dr. Binnur SAĞBAŞ, Yıldız Technical University, TR
Dr. Michael Bozlar, University of Texas at Arlington

ORGANIZING COMMITTEE
Dr. Kerim ÇETİNKAYA, Antalya Belek University, TR
Dr. Binnur SAĞBAŞ, Yıldız Technical University, TR
Dr. Michael Bozlar, University of Texas at Arlington
Dr. Cem Bülent ÜSTÜNDAĞ, Yıldız Technical University, TR
Dr. Burhan DUMAN, Isparta University Of Applied Sciences
Dr. Koray ÖZSOY, Isparta University Of Applied Sciences
Dr. Mir Irfan Ul Haq, Shri Mata Vaishno Devi University
Dr. Lala Bekirova, Azerbaijan State Oil and Industry University
Dr. Tahir Imran Qureshi, NFC Institute of Engineering & Technology
Dr. Serhii Yevseiev, National Technical University Kharkiv Polytechnic Institute
Dr. Ali Zolfagharian, Deakin University, School of Engineering
Dr. Ana Pilar Valerga Puerta, Universidad de Cádiz
Dr. Anton Fecai, University Politehnica of Bucharest
Dr. Ozkan Gokcekaya, Osaka University

EXECUTIVE COMMITTEE
Dr. Pınar Demircioğlu,Aydın Adnan Menderes University,
Dr. Okan ORAL,Akdeniz University
Dr. Kıyas KAYAALP,Isparta University Of Applied Sciences
Dr. M. Cengiz KAYACAN,Süleyman Demirel University
Dr. Okyay KAYNAK,Boğaziçi University
Dr. Mustafa Özgür YAYLI,Uludağ University
Dr. Elmar Yusıflı,Comte University (FR)
Dr. N. Nnamdi Ekere,Wolverhampton University (UK)
Dr. Hüseyin Rıza BÖRKLÜ,Marmara University
Dr. Metin Orhan KAYA,İstanbul Technical University
Dr. Krzysztof Nadolny,Koszalin University of Technology
Dr. Cem SİNANOĞLU,Erciyes University
Dr. Salih ÖZER,Muş Alparslan University
Dr. Mustafa Özgür ÖTEYAKA,Eskişehir Osmangazi University
Dr. Yusuf Cengiz TOKLU,Beykent University
Dr. Yılmaz GÜR,Balıkesir University
Dr. Numan ÇELEBİ,Sakarya University
Dr. Erkan BAHÇE,İnönü Üniversity
Dr. Vehbi BALAK,Harran University
Dr. Selçuk MISTIKOĞLU,İskenderun Technical University
Dr. Mehmet ERMURAT,K.M Sütçü İmam University
Dr. Ahmet FENERCİOĞLU,Gaziosmanpaşa University
Dr. Özgür KİLİT,Yaşar University
Dr. Selahattin Budak,Gümüşhane University
Dr. Ufuk ULUSAN,Mimar Sinan Güzel Sanatlar University

Dr. Murat MAYDA,Karamanoğlu Mehmet Bey University
Dr. Erkan Türker BORAN,Health Sciences University

SCIENTIFIC COMMITTEE

Dr. İbrahim KARAAĞAÇ, Gazi University
Dr. İsmail BÖĞREKÇİ, Aydın Adnan Menderes University,
Dr. Ahu ÇELEBİ,Celal Bayar University
Dr. Abdullah TOGAY,Gazi University
Dr. Laimonas Bartusis,Kaunas University of Technology
Dr. Abdullah ÖZSOY,Isparta Applied Sciences University
Dr. M. Mahir SOFU,Isparta University of Applied Sciences
Dr. Arif GÖK,Amasya University
Dr. Arif ÖZKAN ,Kocaeli University
Dr. Arif UZUN,Kastamonu University
Dr. Ahmet CAN,Necmettin Erbakan University
Dr. Ahmet ERTEN,Osmaniye Korkut Ata University
Dr. Ahmet İhsan AYTEK,Mehmet Akif Ersoy University
Dr. Ahmet Naci ÜNAL,Bahçeşehir University
Dr. Ahmet SAMANCI,Necmettin Erbakan University
Dr. Ali Coşkun DALGIÇ,Gaziantep University
Dr. Ali Rıza TEKİN,Gaziantep University
Dr. Allan E.W. RENNIE,Lancaster University
Dr. Bedri TUÇ,Başkent University
Dr. Bekir YALÇIN,Isparta University of Applied Sciences
Dr. Binnur SAĞBAŞ,Yıldız Technical University
Dr. Burhan DUMAN,Isparta University of Applied Sciences
Dr. Bedri Onur KÜÇÜKYILDIRIM,Yıldız Technical University
Dr. Bekir AKSOY,Isparta University of Applied Sciences
Dr. Bekir DİZDAROĞLU,Karadeniz Technical University
Dr. Berat Barış BULDUM,Mersin University
Dr. Burak DİKİCİ,Atatürk University
Dr. Cem Bülent ÜSTÜNDAĞ,Yıldız Technical University
Dr. Cem SİNANOĞLU,Erciyes University
Dr. Cemal KÖSE,Karadeniz Technical University
Dr. Cemal Merih ŞENGÖNÜL,Atılım University
Dr.. Chua Chee Kai,Nanyang Technological University (SGP)
Dr. David Hughes,Teesside University (UK)
Dr. Dilek KESKİN,Kırıkkale University
Dr. Elmar Yusıflı,Comte University (FR)
Dr. Emeka Amalu,Teesside University (UK)
Dr. Enver Atik,Celal Bayar University
Dr. Eyüp Sabri TOPAL,Akdeniz University
Dr. Filiz ERSÖZ,Karabük University
Dr. Fadime ŞİMŞEK,Kastamonu University
Dr. Fatih TAYLAN,Isparta University of Applied Sciences
Dr. Fatih YILDIZ,Erzurum Technical University
Dr. Fuat KARTAL,Kastamonu University
Dr. Ghulam Hussain,Ghulam Ishaq Khan Institute
Dr. Khalid Rehman,Ghulam Ishaq Khan Institute
Dr. Gökhan BAYAR,Bülent Ecevit University
Dr. Gökhan AKEL,Antalya AKEV University
Dr. Gökmen ATLIHAN,Pamukkale University
Dr. Gözde Sultan ALTUĞ PEDÜK,North Carolina University (USA)
Dr. Gabriel Takyi,Kwame Nkrumah University of Science and Technology(GHA)

Dr. H. Kürşad SEZER,Gazi University
Dr. Hakan YILMAZER,Yıldız Technical University

Dr. Hakan YÜKSEL,Isparta University of Applied Sciences
Dr. Hakan ADA,Kastamonu University
Dr. Hakan KALKAN,Atılım University
Dr. Hakkı SOY,Necmettin Erbakan University
Dr. Murat MAYDA,Karamanoğlu Mehmet Bey University
Dr. Deniz UZUNSOY,Bursa Technical University
Dr. Oğuzhan GÜNDÜZ,Marmara University
Dr. Erkan Türker BORAN,Health Sciences University
Dr. Yüksel ÜNAL,Middle East Technical Üniversity
Dr. Hüseyin GÖKÇE,Çankırı Karatekin University

7th INTERNATIONAL SYMPOSIUM ON 3D PRINTING (Additive Manufacturing) TECHNOLOGIES and DIGITAL INDUSTRY (3D-PTC2023)

SCIENTIFIC PROGRAM

25 October 2023-Wednesday Main Hall (On line/In Person)

For login please join on your computer, mobile app or room device.

Click here to join the meeting

http://online.yildiz.edu.tr/JoinMeeting?organizationid=646bebbc-56ee-42fb-84b7-9ca8d19339bf&meetingid=b969e206-72db-4aaf-8a04-e1290d8f688a

09:30 – 10:00	**REGISTRATION**	
10:00 – 10:30	Dr. Binnur SAĞBAŞ Prof. Dr. Kerim ÇETİNKAYA	Opening Speeches
10:30 – 11:00	Prof. Dr. Tamer YILMAZ	Rector
11:00 – 11:30	Dr. Denis Dowling "In-process monitoring and process feedback during the printing of Ti-6Al-4V alloy parts"	Keynote Speaker
11:30 – 12:00	**COFFE BREAK**	
12:00 – 12:30	Dr. Jon Molina-Aldareguia "4D printing of metallic alloys towards novel shape morphing medical devices"	Keynote Speaker
12:30 – 13:00	Dr. Mahdi Bodaghi "Harmonizing Sustainability, 4D Printing, and Metamaterials in the Future of Soft Robotics"	Keynote Speaker
13:30-14:30	**LUNCH**	
	Session Chairman: Dr. Binnur SAĞBAŞ	
14:30-14:50	"Novel Approach to manufacture powders with tailored chemical composition for additive manufacturing" AMAZEMET	Tomasz Choma
14:50-15:10	"From Powder to Performance with ZEISS Industrial Quality Solutions" ZEISS	Benedikt Krist
15:10-15:30	"The Position and Future of Additive Manufacturing Technologies at ASELSAN" ASELSAN	Dr. Evren TAN
15:30-15:50	"Additive Manufacturing Vision in Turkey with infoTRON" INFOTRON	Cihat AYAN
15:50-16:10	"Additive Manufacturing Solutions" DIGIMODE	Elif Zeynep EMİR
16:10-16:30	**COFFE BREAK**	

25 October 2023-Wednesday **Hall-1** **(On line/In Person)**

For login please join on your computer, mobile app or room device.

Click here to join the meeting

http://online.yildiz.edu.tr/JoinMeeting?organizationid=646bebbc-56ee-42fb-84b7-9ca8d19339bf&meetingid=b969e206-72db-4aaf-8a04-e1290d8f688a

Session Chairman: Dr. Cem Bülent ÜSTÜNDAĞ

16:30-16:50	"Brief Introduction to AM & Related Technologies in Voksel's Portfolio" VOKSEL	Çetin Öney
16:50-17:10	TMC POWDER METAL	Tuğbay Ataman
17:10-17:30	"Digitalization in the Manufacturing Sector" AUTODESK	Sercan Posacı
17:30-17:50	"Green management Journey in Koluman" KOLUMAN	Dr. Banu Özkeser

25 October 2023-Wednesday **Hall-2** **(On line/In Person)**

Session Chairman: Dr. Ahu ÇELEBİ

16:30-16:50	"Analysis Of Defects During the Manufacturing Of Lattice Parts By Selective Laser Sintering"	Kayacan, Mevlüt Yunus*; Yılmaz, Mustafa Safa; Üzün, Ahmet
16:50-17:10	"Effects Of Heat Treatment on Wear And Microstructure Properties Of AlSi10Mg Alloys Produced By Selective Laser Sintering And Casting Method"	Çelebi, Ahu*; Çetinkaya, Semih; İMANÇ, Mustafa Mertcan
17:10-17:30	"Garments Industry 5.0: Transforming Through Digital Integration Of 3d Virtual Measurement Data and Characteristics"	DONMEZER, Semih*; DEMIRCIOGLU, Pinar; BOGREKCI, Ismail; Baş, Gökçen; Durakbasa, M. Numan
17:30-17:50	"Optimization of Process Parameters and Mechanical Property Analysis Of PLA Parts Manufactured By FDM Using A Grey Relational Analysis"	Kıtay, Özhan*; Alaca, Ömer

25 October 2023-Wednesday **Hall-3** **(On line/In Person)**

Session Chairman: Dr. Ömer EYERCİOĞLU

16:30-16:50	"A Design for Additive Manufacturing Methodology applied to Boat Bow Chock"	Kılıç, Altuğ*; Ayaydın, Mehmet; Tasdemir, Ahmet; Hayran, Necip; Oğuz, Ali
16:50-17:10	"Joining Parts Manufactured by Additive Manufacturing Method With Welding Method Using Filling Material"	Eraslan , Cansu Sibel*; Küçüktürk, Gökhan
17:30-17:50	"Finite Element Analysis of Residual Stresses In Conformal Hybrid Non-Planar Large-Scale Additive Manufacturing: Evaluating Thermal Effects After Abs – Steel Bonding"	Aladag, Mehmet*; Eyercioğlu, Ömer; Tek, Engin; Akeloglu, Mehmet Ali; Zglobicka, Izabela ; Kurzydłowski, Krzysztof Jan

26 October 2023- Thursday Hall-1 *(Online/In person)*

For login please join on your computer, mobile app or room device.

Click here to join the meeting

http://online.yildiz.edu.tr/JoinMeeting?organizationid=646bebbc-56ee-42fb-84b7-9ca8d19339bf&meetingid=f017b1e5-8872-4cb8-a1f3-ee75851e002f

	Session Chairman: Dr. Binnur SAĞBAŞ	
10.00-10.30	"Industrialized metal additive manufacturing" Prof Ian Gibson	Keynote Speaker
10.30-11.00	"From single methylcellulose-based bioinks to complex bioinks" Miguel A. Mateos Timoneda	Keynote Speaker
11.00-11.30	**COFFE BREAK**	
	Session Chairman: Dr. Tolga MERT	
11.30-11.50	ALPOMET	Yağız Akyıldız
11.50-12.10	METAM	Mustafa Arslan
12.10-12.30	AGL	Mustafa Pehlivan
13.30--14.30	**LUNCH**	
	Session Chairman: Dr. Murat AYDIN	
14:30-14:50	"Taguchi Analysis of FDM 3D Printed PLA Parts Based on Their Tensile Strength"	Temiz, Abdurrahim *; Öztürk, Fatih Huzeyfe; Aydın, Murat
14:50-15:10	"Efficiency Evaluation of Smart Manufacturing Systems for Monitoring Production Efficiency and Quality"	Zurnaci, Erman*; Uzuner, Sabri; Nas, Engin
16:10-16:30	**COFFE BREAK**	
	Session Chairman: Dr. Binnur SAĞBAŞ	
16:50-17:10	"Production of Alginate/Gelatin Scaffolds Loaded with Cinnamaldehyde and Meropenem Using a 3D Bioprinter for Corneal Injuries"	Cesur, Sümeyye ; Gunduz, Oguzhan; Aydoğdu, Perihan*; Örnek, Emine Beyza; Babür, Ece; Akpek, Ali
17:10-17:30	"Molten Metal Deposition: The Single-Step Direct Aluminium Additive Manufacturing Technology"	Galle, Jonas*
17:30-17:50	"Effect of artificial aging procedures on flexural strength of different 3D printed resins for pediatric dental crowns"	Buyuk, Kutalmış*; Korkmaz, Yasemin Nur; Simsek, Huseyin; Abay, Feridun
17:50-18:10	"A Combined Finite Element-Machine Learning Framework for Developing Printability Maps in Laser Powder Bed Fusion of AISI 316L Stainless Steel"	Muhammad Arif Mahmood and Marwan Khraisheh*

26 October 2023- Thursday Hall-2 *(Online/In person)*

For login please join on your computer, mobile app or room device.

Click here to join the meeting

http://online.yildiz.edu.tr/JoinMeeting?organizationid=646bebbc-56ee-42fb-84b7-9ca8d19339bf&meetingid=5bfb610c-c7b6-48dc-b0dc-958da5b63389

Session Chairman: Dr. Ömer EYERCİOĞLU

11.30-11.50	"Numerical Modelling of the Warping Behaviour in Filament-Based 3D-Printed Models"	Ramful,Raviduth*
11.50-12.10	"Design And Performance Analysis of Different Flame Hidden Structures"	Özaslan Halil; Bozdemir, Mustafa*
12.10-12.30	"Investigation of Ultem 9085 Material Reinforcement with Nylon12-CF Material"	Konan, Onur*; Yapici, Ataberk; Gümüşel, Okan
12.30-12:50	"Surface Quality Enhancing Of Internal Channels Of Additively Manufactured Parts By Using Abrasive Flow Machining (Afm)"	EYERCİOĞLU, Ömer*; Karadağ, Mustafa Emre; Akeloğlu, Mehmet Ali; Aladag, Mehmet
13.30--14.30	**LUNCH**	

Session Chairman: Dr. Ayşegül ASLAN

14:30-14:50	"Design And Physical Property Evaluation Of Prototype Models Produced Within The Scope Of The Teachers' 3d Material Journey Project"	Aslan, Ayşegül*; Aslan, Mustafa; Çava, Kutay; Özpınar, İrem
14:50-15:10	"The Systematic Review of the Studies Conducted in Turkey on the Topic of Applying 3D Printing in Mathematics Education"	Akın, Ayça*; Sezgin, H. Seda
15:10-15:30	"Bending Behaviour of Additively Manufactured Gyroid-Based Lattice Beams"	Kazemivand, Saeed; Nikaeen, Golbarg; Sadeghi, Mohammad Hossein*; Koc, Bahattin
15:30-15:50	"The Effects of Inter Layer Pressurized Air Cooling on Mechanical Properties and Microstructure of Thin Wall Manufactured by CMT WAAM"	Eken, Gökçe*; Mert, Tolga
15:50-16:10	"Homogenized Properties Of Periodic Lattice Materials"	Demirtunç, Mehmet*; Görgülüarslan, Recep Muhammet

26 October 2023- Thursday Hall-3 Online/In Person

For login please join on your computer, mobile app or room device.
Click here to join the meeting

http://online.yildiz.edu.tr/JoinMeeting?organizationid=646bebbc-56ee-42fb-84b7-9ca8d19339bf&meetingid=eccd8e21-9b05-4a13-a06d-2bdbfec4bdf5

	Session Chairman: Dr. Nazım BABACAN	
11.30-11.50	"Effect Of Design And Manufacturing Criteria On Tensile Behaviour Of Ti6al4v Lattice Structures Produced By Laser Powder Bed Fusion"	Sagbas, Binnur*; Gürkan, Doruk; Kıran, Kadir
11.50-12.10	"Investigation of Porcelain Bond Strength of Metal Frameworks Produced by SLM at Different Laser Powers"	Karahasan, Betül*; Özdemir Doğan, Derya; Babacan, Nazim
12.10-12:30	"Manufacturing of Gyroid-Based Lattice Structures Using A Combined Method of Investment Casting And Additive Manufacturing"	Heydari, Hassan; Nikaeen, Golbarg; Sadeghi, Mohammad Hossein*
12.30-12.50	"Investigation Of The Compression Behavior Of The Additively Manufactured Glass-Fiber Reinforced Composites Via Vat-Photopolymerization"	Çava, Kutay; İpek, Hüseyin; Usun, Altug; Aksa, Hüseyin Can; Aslan, Mustafa*
13.30--14.30	**LUNCH**	
	Session Chairman: Dr. Nazım BABACAN	
14:30-14:50	"The Advantages Of Using 3d Printing Technology In The Food Industry"	Tiryaki, Gizem*; Nakilcioğlu, Emine
14:50-15:10	"The Impact of Sustainable Innovation on Business Performance"	Sarikaya Ozkeser, Banu*
15:10-15:30	"Investigation of Mechanical Properties and Microstructures of Three Different Biocompatible Co-Cr Alloys Produced by Laser Powder Bed Fusion"	Yildiz, Muhammed Taha; Babacan, Nazim*
15:30-15:50	"Gas Atomization of Ni-Hard Alloy"	Muratal, Onur*; Yamanoğlu, Ridvan ; Duran, Can; Gönülalan, Yiğit; Akyildiz, Yağiz ; Gül Koç, Funda ; Barutcuoğlu, Burak
16:10-16:30	**COFFE BREAK**	
	Session Chairman: Dr. Mustafa Aslan	
16:30-16:50	"Thermal Treatment And Characterization Of Ti-6al-4v Alloy Produced By Slm (Selective Laser Melting) Method"	Appavuravther, Esra Zerina*
16:50-17:10	"Adoption of Metal Additive Manufacturing In NNPC Limited: Current State And Challenges"	Umar, Al-Amin B*
17:10-17:30	"Double-Layer Drug-Loaded Tumor Dressing Production By 3d Printing And Electrospining Method"	Bingöl, Ayşe Betül*; Üstündağ, Cem Bülent
17:30-17:50	"Production Of A Personalized Mandible Prosthesis From Ct Images Using The Powder Bed Fusion Process Method"	Aksa, Hüseyin Can; Çava, Kutay; Usun, Altug; İpek, Hüseyin; Aslan, Mustafa*; Varol, Temel

27 October 2023- Friday Hall-1 (Online/In person)

For login please join on your computer, mobile app or room device.

Click here to join the meeting

http://online.yildiz.edu.tr/JoinMeeting?organizationid=646bebbc-56ee-42fb-84b7-9ca8d19339bf&meetingid=863207b1-8a9f-49f7-819a-3a9172410f97

	Session Chairman: Dr. Savaş DİLİBAL	
10.00-10.20	"Hardness Variation And Microstructural Characterization Of Bimetallic 316l Stainless Steel/Inconel 625 Waam Component"	Kumek, Hülya; Gürol, Uğur*; Dilibal, Savaş; Koçak, Mustafa
10.20-10.40	"Road accident forecasting using machine learning algorithms "	Zermane, Hanane*; Zermane, Abderrahim
10:40-11.00	"The Effect Of Milling Speed On The Properties Of Co-Cr-Mo-W Particles Recycled From Slm Support Scraps"	Aksa, Hüseyin Can; Varol, Temel*; Akçay, Serhatcan Berk
11.00-11.30	**COFFE BREAK**	
	Session Chairman: Dr. Burhan DUMAN	
11.30-11.50	"Development And Dosimetric Verification Of 3d Mould Applicator In Brachytherapy"	Çavdar Karaçam, Songül*; Tunçman, Duygu; Dağdelen, Meltem; Uzel, Ömer Erol
11.50-12.10	"Radiological Evaluation Of The Effects Of Infill Density On 3d Printed Pla Samples"	Azaklıoğlu, Deniz*; Çavdar Karaçam, Songül; Pastacı Özsobacı, Nural; Özçelik, Derviş
12.10-12.30	"Determining Mechanical Properties Of Ti6al4v Additive Manufactured Parts At Different Test Conditions"	Sagbas, Binnur*; Ovacık, Taylan
13.30--14.30	**LUNCH**	
	Session Chairman: Dr. Yusuf Cengiz TOKLU	
14:30-14:50	"Dosimetric Evaluation Of Pla And Abs Materials Produced By Two Different Production Techniques"	Çavdar Karaçam, Songül*; Tunçman, Duygu; Şahin, tülin; Şahin, Şenol; Ergen, Şefika Arzu; Dağdelen, Meltem; Uzel, Ömer Erol; Çolpan Öksüz, Didem
14:50-15:10	"Additive Manufacturing of Concrete Structures and Concrete Elements, Optimization of the Time Consumed"	Toklu, Yusuf Cengiz; ÇERÇEVİK, Ali Erdem*
15:10-15:30	"Design, Manufacturing and Finite Element Assessment of Functionally Graded Auxetic Structures"	Özen, Mert*; Kenan, Hamit; Azeloğlu, Cumhur Oktay
16:10-16:30	**COFFE BREAK**	

27 October 2023- Friday Hall-2 (Online/In person)

For login please join on your computer, mobile app or room device.

Click here to join the meeting

http://online.yildiz.edu.tr/JoinMeeting?organizationid=646bebbc-56ee-42fb-84b7-9ca8d19339bf&meetingid=53b547fa-257a-442a-9a50-ed48a4be2841

	Session Chairman: Dr. Binnur Sagbas	
10.00-10.20	"Prediction Of Surface Roughness Of Additive Manufactured Alsi10mg Parts Via Machine Learning"	Sagbas, Binnur*; Güngör, Hikmet Ayberk; Coşkun, Mert
10.20-10.40	"3d Printing Personalized Treatment Methods For Bone Tissue Engineering Applications"	Oktay, Büşra*; Bingöl, Ayşe Betül; Oktay, Aysel; Üstündağ, Cem Bülent
10:40-11.00	"Time And Cost Evaluation Of The Use Of Filament And Granule Material In Polymer Material Fed Additive Manufacturing Technology"	Köbeloğlu, Ahmet*; Çetinkaya, Kerim; Altun, Suat
11.00-11.30	**COFFE BREAK**	
	Session Chairman: Dr. Koray ÖZSOY	
11.30-11.50	Investigation Of The Mechanical Properties Of Ti6al4v Alloy Flexural Test Samples Fabricated By Electron Beam Melting Method	Sıcakdemir, Burak*; Pazarcıkcı, Arda; Özsoy, Koray
11.50-12.10	"3d Printing Biofunctional Wound Dressing Design For Diabetic Foot Ulcer"	Yıldız, Ertuğrul*; Tuğlu, Sude; Karadağ , Zahide; Gençaslan, Pınar; Baya, Aya ; Qasim, Anas Ayman; Bingöl, Ayşe Betül; Oktay, Büşra; Üstündağ, Cem Bülent
12.10-12.30	"A New Industrial Microwave-Assisted Distillation System for Essential Oil Extraction from Medicinal and Aromatic Plants "	Doğan, Habib*; Temiz, Ahmet Faruk; Genç, Abdullah
13.30--14.30	**LUNCH**	
	Session Chairman: Dr. Burhan DUMAN	
14:30-14:50	"The Use Of Orthoses Made With 3d Printer In Upper Extremity Rehabilitation: A Systematic Review"	Sarışahin, Sümeyye*; Çorakçı Yazıcıoğlu, Zeynep
14:50-15:10	"Development Of Low and High Pressure Components As A Single Product"	Maden, Hakan*; Özsarıkaya , Bilal; Kocer, Mustafa
15:10-15:30	"Industrial Defect Detection by Using Object Detection Methods"	Duman, Burhan*
16:10-16:30	**COFFE BREAK**	

27 October 2023- Friday Hall-3 *(Online/In person)*

For login please join on your computer, mobile app or room device.

Click here to join the meeting

http://online.yildiz.edu.tr/JoinMeeting?organizationid=646bebbc-56ee-42fb-84b7-9ca8d19339bf&meetingid=7d8e8c94-359e-4018-a2eb-3ad8c1049835

	Session Chairman: Dr.Mine Uysal Uslu	
10.00-10.20	"The Design Of The Organic-Structured Unmanned Aerial Vehicle Body Produced By 3d Printing Process Using Topology Optimization"	Uslu Uysal, Mine *; Kahveci, Nursen
10:20-10.40	"Investigation Of The Effect Of Gas Pressure On Grain Size In The Production Of Alsi10mg Aluminum Alloy Powder By Gas Atomisation Method"	Boz, Mustafa; Korkmaz, Selim*; Kılıç, Namık; Güngör, Yeşim; Gök, Ertuğrul
11.00-11.30	**COFFE BREAK**	
	Session Chairman: Dr. Hossein Mohammad Sadeghi	
11.30-11.50	"Investigation Of Microstructure And Porosity Properties Of Alsi10mg Alloys Produced Via Laser Powder Bed Fusion"	Sagbas, Binnur*; Coşkun, Mert
11.50-12.10	"An Initial Evaluation of The Biological Properties Of The Surface-Modified 3d-Printed Porous 316l Stainless Steel Samples"	Yelten, Azade*; Haliloglu, Alper; Ercan, Batur
12.10-12.30	"Numerical And Experimental Investigation On Mechanical Properties Of Gyroid-Based Lattice Structures With Different Cell Orientations"	Nikaeen, Golbarg; Sadeghi, Mohammad Hossein*; Jamshidi, Maryam;Sagbas, Binnur
13.30-14.30	**LUNCH**	
	Session Chairman: Dr. Koray ÖZSOY	
14:30-14:50	"Investigation Of A Liquid-Cooled Cold Plate Produced With Additive Manufacturing Technologies"	Parlak, Murat*; Doğan, Oğuz ; Örs, Ergun
14:50-15:10	"10 Areas Of 3d Printing Technology Has Significantly Impacted Our Lives"	Appavuravther, Esra Zerina*
15:10-15:30	"Design and Production of a Microneedle Patch-Based Drug Delivery System for Melanoma Skin Cancer Treatment"	Saraj, shhd*; Karzoun, Louna; ÜSTÜNDAĞ, Cem Bülent; Bingöl, Ayşe Betül; Oktay, Büşra; şenel, Ilkay; SÜLEYMAN, SIMAF; altabel, Ahmad; bedir, Tuba
15:30-15.50	"Investigating the machinability of metal additive manufacturing: A conceptual frame"	Pazarcıkcı, Arda; Çevik Zihni Alp; Özsoy Koray
15:50-16.10	"Investigation Of Fuzzy Logic Approaches In FDM Method Processing Parameters"	Özsoy, Koray*; Kuruoğlan, Ebru
16:10-16:30	**COFFE BREAK**	

CONTENTS

INDUSTRIALIZED METAL ADDITIVE MANUFACTURING 19
IN-PROCESS MONITORING AND PROCESS FEEDBACK DURING THE PRINTING OF TI-6AL-4V ALLOY PARTS 20
FROM SINGLE METHYLCELLULOSE-BASED BIOINKS TO COMPLEX BIOINKS 21
HARMONIZING SUSTAINABILITY, 4D PRINTING, AND METAMATERIALS IN THE FUTURE OF SOFT ROBOTICS 22
INVESTIGATION OF FUZZY LOGIC APPROACHES IN FDM METHOD PROCESSING PARAMETERS 23
THE ADVANTAGES OF USING 3D PRINTING TECHNOLOGY IN 24
THE FOOD INDUSTRY 24
OPTIMIZATION OF PROCESS PARAMETERS AND MECHANICAL PROPERTY ANALYSIS OF PLA PARTS MANUFACTURED BY FDM 25
USING A GREY RELATIONAL ANALYSIS 25
THE DESIGN OF THE ORGANIC-STRUCTURED UNMANNED AERIAL VEHICLE BODY PRODUCED BY 3D PRINTING PROCESS USING TOPOLOGY OPTIMIZATION 26
ANALYSIS OF DEFECTS DURING THE MANUFACTURING OF 27
LATTICE PARTS BY SELECTIVE LASER SINTERING 27
A DESIGN FOR ADDITIVE MANUFACTURING METHODOLOGY APPLIED TO BOAT BOW CHOCK 28
EVALUATION OF POST-PROCESSING ON THE CORROSION BEHAVIOUR OF ALSI10MG BY SELECTIVE LASER MELTING PROCESS 29
INVESTIGATION OF THE MECHANICAL PROPERTIES OF TI6AL4V ALLOY FLEXURAL TEST SAMPLES FABRICATED BY ELECTRON BEAM MELTING METHOD 30
DEVELOPMENT OF LOW AND HIGH PRESSURE COMPONENTS AS 31
A SINGLE PRODUCT 31
DESIGN AND PHYSICAL PROPERTY EVALUATION OF 32
PROTOTYPE MODELS PRODUCED WITHIN THE SCOPE OF THE 32
TEACHERS' 3D MATERIAL JOURNEY PROJECT 32
ADDITIVE MANUFACTURING OF CONCRETE STRUCTURES AND CONCRETE ELEMENTS, OPTIMIZATION OF THE TIME CONSUMED 33
DESIGN, MANUFACTURING AND FINITE ELEMENT ASSESSMENT OF 34
FUNCTIONALLY GRADED AUXETIC STRUCTURES 34
THE SYSTEMATIC REVIEW OF THE STUDIES CONDUCTED IN TURKEY ON THE TOPIC OF APPLYING 3D PRINTING IN MATHEMATICS EDUCATION 35
THE EFFECTS OF INTER LAYER PRESSURIZED AIR COOLING ON MECHANICAL PROPERTIES AND MICROSTRUCTURE OF THIN WALL MANUFACTURED BY CMT WAAM 36
RADIOLOGICAL EVALUATION OF THE EFFECTS OF INFILL 37

DENSITY ON 3D PRINTED PLA SAMPLES 37
DOSIMETRIC EVALUATION OF PLA AND ABS MATERIALS 38
PRODUCED BY TWO DIFFERENT PRODUCTION TECHNIQUES 38
DEVELOPMENT AND DOSIMETRIC VERIFICATION of 3D MOULD APPLICATOR IN BRACHYTHERAPY 39
INVESTIGATION OF THE COMPRESSION BEHAVIOR OF THE 40
ADDITIVELY MANUFACTURED GLASS-FIBER REINFORCED 40
COMPOSITES VIA VAT-PHOTOPOLYMERIZATION 40
PRODUCTION OF A PERSONALIZED MANDIBLE PROSTHESIS 41
FROM CT IMAGES USING THE POWDER BED FUSION PROCESS 41
METHOD 41
TIME AND COST EVALUATION OF THE USE OF FILAMENT AND GRANULE MATERIAL IN POLYMER MATERIAL FED ADDITIVE MANUFACTURING TECHNOLOGY 42
NUMERICAL AND EXPERIMENTAL INVESTIGATION ON 43
MECHANICAL PROPERTIES OF GYROID-BASED LATTICE 43
STRUCTURES WITH DIFFERENT CELL ORIENTATIONS 43
BENDING BEHAVIOUR OF ADDITIVELY MANUFACTURED 44
GYROID-BASED LATTICE BEAMS 44
MANUFACTURING OF GYROID-BASED LATTICE STRUCTURES 45
USING A COMBINED METHOD OF INVESTMENT CASTING AND 45
ADDITIVE MANUFACTURING 45
INVESTIGATION OF MECHANICAL PROPERTIES AND MICROSTRUCTURES OF THREE DIFFERENT BIOCOMPATIBLE CO-CR ALLOYS PRODUCED BY LASER POWDER BED FUSION 46
INVESTIGATION OF PORCELAIN BOND STRENGTH OF METAL FRAMEWORKS PRODUCED BY SLM AT DIFFERENT LASER POWERS 47
HOMOGENIZED PROPERTIES OF PERIODIC LATTICE MATERIALS 48
A NEW INDUSTRIAL MICROWAVE-ASSISTED DISTILLATION SYSTEM FOR ESSENTIAL OIL EXTRACTION FROM MEDICINAL AND AROMATIC PLANTS 49
GAS ATOMIZATION OF Ni-HARD POWDER 50
INVESTIGATION OF ULTEM 9085 MATERIAL REINFORCEMENT WITH NYLON12-CF MATERIAL COMPONENTS 51
EFFECT of DESIGN and MANUFACTURING CRITERIA on TENSILE BEHAVIOUR of Ti6Al4V LATTICE STRUCTURES PRODUCED by 52
LASER POWDER BED FUSION 52
DESIGN AND PERFORMANCE ANALYSIS OF DIFFERENT FLAME HIDDEN STRUCTURES 53
INVESTIGATION of MICROSTRUCTURE AND POROSITY 54
PROPERTIES of AlSi10Mg ALLOYS PRODUCED VIA LASER 54
POWDER BED FUSION 54
PREDICTION of SURFACE ROUGHNESS of ADDITIVE 55
MANUFACTURED AlSi10Mg PARTS VIA MACHINE LEARNING 55

NUMERICAL MODELLING OF THE WARPING BEHAVIOUR IN FILAMENT-BASED 3D-PRINTED MODELS 56
GARMENTS INDUSTRY 5.0: TRANSFORMING THROUGH DIGITAL INTEGRATION OF 3D VIRTUAL MEASUREMENT DATA AND CHARACTERISTICS 57
AN INITIAL EVALUATION OF THE BIOLOGICAL PROPERTIES OF 58
THE SURFACE-MODIFIED 3D-PRINTED POROUS 316L STAINLESS 58
STEEL SAMPLES 58
PRODUCTION OF ALGINATE/GELATIN SCAFFOLDS LOADED WITH CINNAMALDEHYDE AND MEROPENEM USING A 3D BIOPRINTER FOR CORNEAL INJURIES 59
DETERMINING MECHANICAL PROPERTIES of Ti6Al4V ADDITIVE MANUFACTURED PARTS at DIFFERENT TEST CONDITIONS 60
DOUBLE-LAYER DRUG-LOADED TUMOR DRESSING PRODUCTION BY 3D PRINTING AND ELECTROSPINING METHOD 61
3D PRINTING PERSONALIZED TREATMENT METHODS FOR 62
BONE TISSUE ENGİNEERİNG APPLICATIONS 62
3D PRINTING BIOFUNCTIONAL WOUND DRESSING DESIGN 63
FOR DIABETIC FOOT ULCER 63
DESIGN AND PRODUCTION OF A MICRONEEDLE PATCH-BASED DRUG DELIVERY SYSTEM FOR MELANOMA SKIN CANCER TREATMENT 64
EFFICIENCY EVALUATION OF SMART MANUFACTURING SYSTEMS FOR MONITORING PRODUCTION EFFICIENCY AND QUALITY 65
EFFECTS OF HEAT TREATMENT ON WEAR AND MICROSTRUCTURE PROPERTIES OF ALSI10MG ALLOYS PRODUCED BY SELECTIVE LASER SINTERING AND CASTING METHOD 66
JOINING PARTS MANUFACTURED BY ADDITIVE MANUFACTURING METHOD WITH WELDING METHOD USING FILLING MATERIAL 67
FINITE ELEMENT ANALYSIS OF RESIDUAL STRESSES IN CONFORMAL HYBRID NON-PLANAR LARGE-SCALE ADDITIVE MANUFACTURING: EVALUATING THERMAL EFFECTS AFTER ABS – STEEL BONDING 68
MOLTEN METAL DEPOSITION: THE SINGLE-STEP DIRECT ALUMINIUM 69
ADDITIVE MANUFACTURING TECHNOLOGY 69
THE USE OF ORTHOSES MADE WITH 3D PRINTER IN UPPER EXTREMITY REHABILITATION: A SYSTEMATIC REVIEW 70
TAGUCHI ANALYSIS OF FDM 3D PRINTED PLA PARTS BASED ON THEIR TENSILE STRENGTH 71
SURFACE QUALITY ENHANCING OF INTERNAL CHANNELS OF ADDITIVELY MANUFACTURED PARTS BY USING ABRASIVE FLOW MACHINING (AFM) 72
ROAD ACCIDENT FORECASTING USING MACHINE LEARNING ALGORITHMS 73
THE EFFECT OF MILLING SPEED ON THE PROPERTIES OF CO-CR-MO-W PARTICLES RECYCLED FROM SLM SUPPORT SCRAPS 74
ADOPTION OF METAL ADDITIVE MANUFACTURING IN NNPC LIMITED: CURRENT STATE AND CHALLENGES 75
THE IMPACT OF SUSTAINABLE INNOVATION ON 76
BUSINESS PERFORMANCE 76

THERMAL TREATMENT AND CHARACTERIZATION OF TI-6AL-4V ALLOY PRODUCED BY SLM (SELECTIVE LASER MELTING) METHOD 77

10 AREAS OF 3D PRINTING TECHNOLOGY HAS SIGNIFICANTLY IMPACTED OUR LIVES 78

INVESTIGATION OF A LIQUID-COOLED COLD PLATE PRODUCED WITH ADDITIVE MANUFACTURING TECHNOLOGIES 79

HARDNESS VARIATION AND MICROSTRUCTURAL CHARACTERIZATION OF BIMETALLIC 316L STAINLESS STEEL/INCONEL 625 WAAM COMPONENT 80

INVESTIGATION OF THE EFFECT OF GAS PRESSURE ON GRAIN SIZE IN THE PRODUCTION OF ALSI10MG ALUMINUM ALLOY POWDER BY GAS ATOMISATION METHOD 81

DEFECT DETECTION OF INDUSTRIAL PRODUCTS WITH DEEP LEARNING METHODS ON SINGLE BOARD COMPUTER 82

INVESTIGATING THE MACHINABILITY OF METAL ADDITIVE MANUFACTURING: A CONCEPTUAL FRAME 83

A COMBINED FINITE ELEMENT-MACHINE LEARNING FRAMEWORK FOR DEVELOPING PRINTABILITY MAPS IN LASER POWDER BED FUSION OF AISI 316L STAINLESS STEEL 84

EFFECT OF ARTIFICIAL AGING PROCEDURES ON FLEXURAL STRENGTH OF DIFFERENT 3D PRINTED RESINS FOR PEDIATRIC DENTAL CROWNS 85

Oral Presentation

INDUSTRIALIZED METAL ADDITIVE MANUFACTURING

Ian Gibson

Director of Fraunhofer Innovation Platform for Advanced Manufacturing Dept. of Design, Production & Management Horst building, room W245 University of Twente.

ABSTRACT

This presentation will cover how the Fraunhofer Innovation Platform at the University of Twente is developing an industrial demonstrator to explore how manufacturers can integrate metal printing into their capabilities. Both laser-based powder bed fusion and metal wire-based directed energy deposition technology are of interest to manufacturers in the East Netherlands region and the demonstrator aims to explore how 3D scanning, wire-cutting, and multi-axis machining can be used with metal additive manufacturing to address various manufacturing challenges.

Oral Presentation

IN-PROCESS MONITORING AND PROCESS FEEDBACK DURING THE PRINTING OF TI-6AL-4V ALLOY PARTS

Denis P.Dowling[a*], Cathal Hoare[a]

[a] University College Dublin, I-Form Centre, School of Mechanical and Materials Engineering, Ireland

ABSTRACT

This study details the results of an investigation of the use of machine learning (ML), combined with a process digital twin, to provide feedback during the printing of alloy parts during Laser Powder Bed Fusion (L-PBF). A co-axial photodiode-based process monitoring system was used to generate data relating to both the powder meltpool and the laser, during the printing of Ti-6Al-4V lattice structures. The resulting in-process data was evaluated using an unsupervised machine learning approach called the Search and TRace AnomalY algorithm (STRAY). A rules based decision support system was then used to combine the results of the ML evaluation, with materials characterization data from previous print runs. A decision support system was successfully developed to reason about patterns of observed anomalous conditions, in order to suggest actions which may help to address the source of identified anomalies. The ability of this ML approach to provide operator feedback on L-PBF process anomalies in <20 seconds was successfully demonstrated.

Keywords: Additive Manufacturing (L-PBF), Machine Learning, In-process monitoring.

Oral Presentation

FROM SINGLE METHYLCELLULOSE-BASED BIOINKS TO COMPLEX BIOINKS

Maximilian Jergitsch[a,b], Roman A. Perez[a,b], Miguel A. MateosTimoneda[a,b,*]

[a] Bioengineering Institute of Technology, Universitat Internacional de Catalunya, c/ Josep Trueta s/n, 08195 Sant Cugat del Vallès (Barcelona), Spain
[b] Department of Basic Sciences, Faculty of Medicine and Health Sciences, Universitat Internacional de Catalunya, c/ JosepTrueta s/n, 08195 Sant Cugat del Vallès (Barcelona), Spain.

ABSTRACT

Printability in 3D extrusion bioprinting encompasses extrudability, filament formation, and shape fidelity. Rheological properties can predict the shape fidelity of printed hydrogels. In particular, tan(δ), the ratio between loss (G″) and storage (G′) modulus (G″/G′), is a powerful indicator of printability. In this talk, we will explore the effect of different salt, sucrose, and MC concentrations on tan(δ), and therefore the printability of methylcellulose (MC) hydrogels. Salt and sucrose increased G′, lowering tan(δ) and enabling printing of scaffolds with high shape fidelity. Conversely, MC concentration increased G″ and G′, having a lesser effect on tan(δ). Shape fidelity of three formulations with similar G′ but varying tan(δ) values were compared. Higher tan(δ) led to reduced height, while lower tan(δ) improved shape fidelity. Cell viability increased when reducing MC content, extrusion rate, and nozzle gauge. Higher MC concentration (G′ > 1.5kPa) increased the influence of needle size and extrusion rate on cell viability. Hydrogels with G′ < 1kPa could be extruded at high rates with small nozzles, minimally affecting cell viability. This work shows a direct relationship between tan(δ) and printability of MC-based hydrogels. Lowering the complex modulus of hydrogels, mitigates extrusion stress, thus improving cell survival. These results will help in the further development of more complex bioinks and structures, which can give rise to novel constructs for uses as 3D models and scaffolds for Tissue Engineering and Regenerative Medicine.

Oral Presentation

HARMONIZING SUSTAINABILITY, 4D PRINTING, AND METAMATERIALS IN THE FUTURE OF SOFT ROBOTICS

Mahdi Bodaghi

Department of Engineering, School of Science and Technology, Nottingham Trent University, Nottingham NG11 8NS, UK

ABSTRACT

I'll take you on a transformative journey into the future of sustainable soft robotics and metamaterials, powered by the revolutionary capabilities of 4D printing. In this keynote, I'll guide you through a series of my pioneering research endeavours that converge at the intersection of sustainability, metamaterials, and the cutting-edge world of 4D printing.

Our journey begins with Sustainable Soft Actuators (SSAs), a groundbreaking fusion of sustainability and soft robotics. Through advanced 4D printing techniques and thoughtful material choices, I've been able to create SSAs that deliver maximum performance with minimal environmental impact. These innovations promise versatile applications, from human-machine interaction to sustainable wearables. I'll introduce the next frontier of soft robotics with our shape memory meta-laminar jamming actuators, boasting enhanced performance and eco-friendliness. These creations redefine the possibilities of sustainable robotic systems with remarkable shape recovery and locking capabilities. I'll also unveil magneto-electroactive shape memory polymer composites, crafted through 4D printing, transforming industries like packaging by reducing waste and energy consumption while enabling intricate shape transformations. Our journey doesn't end there. I'll share insights from recent research on soft pneumatic actuators, bio-inspired lattice chambers, silicon-based soft parallel robots, reversible composite-based shape memory alloy soft actuators and AI-powered 4D printed robotic joints with variable stiffness. These innovations are united by my shared commitment to sustainability, 4D printing, and metamaterials, shaping a greener and more efficient future in robotics and manufacturing.

Prepare to be inspired as I unlock the boundless potential of these groundbreaking technologies, envisioning a world where sustainable soft robotics and metamaterials seamlessly merge through the transformative power of 4D printing.

Oral Presentation

INVESTIGATION OF FUZZY LOGIC APPROACHES IN FDM METHOD PROCESSING PARAMETERS

Ebru KURUOĞLAN[a*], Koray ÖZSOY[b]

[a]Isparta University of Applied Sciences, Technology Faculty, Mechatronics Engineering Department, TURKIYE
[b]Isparta University of Applied Sciences, Isparta OSB MYO, Machine and Metal Technologies, TÜRKİYE

ABSTRACT

Industry 4.0 revolution is increased in importance as it is the driving force of today's the digital and artificial intelligence production system. Additive manufacturing technology, one of the components of Industry 4.0, has spread widely in an era where production lines are changing and information is transferred digitally. Additive manufacturing is a production technology that has the ability to produce innovative and complex components without the need for a secondary process such as machining or assembly. Additive manufacturing technique, known as Fused Deposition Modeling (FDM), is the most used technique in terms of cost and usage. Processing parameters are very important in FDM techniques. Fuzzy logic is today frequently used in estimating of the processing parameters. In the FDM technique, fuzzy logic rules are performed for the control of processing parameters with fuzzy logic, which can be more efficient and better product quality. In this study, it was aimed to present a theoretical framework for the optimization of manufacturing parameters with fuzzy logic modeling in the FDM additive manufacturing process. For these purposes, it was carried out a detailed evaluation of the studies on FDM additive manufacturing process optimization with fuzzy logic.

Keywords: *Additive manufacturing, Fused Deposition Modelling, Fuzzy Logic, Digital Industry.*

Oral Presentation

THE ADVANTAGES OF USING 3D PRINTING TECHNOLOGY IN THE FOOD INDUSTRY

Emine NAKİLCİOĞLU[a], Gizem TİRYAKİ[b]

[a]Ege University, , Engineering Faculty, Food Engineering Department, TURKEY
bEge University, Graduate School of Natural and Applied Sciences, Food Engineering, TURKEY

ABSTRACT

3D printing technology is a method applied to create structures by adding layers of material under computer control. Today, it has an important place in the production of physical models in the field of medicine and dentistry, as well as in many areas such as construction, pharmaceutical, computer, and food industries. 3D printing, which has a wide application area in the food industry, is becoming the focus of attention as the demand for functional foods and dietary nutrition increases. The use of 3D printing in food formulation and manufacturing processes is an innovation that promises to revolutionize. Using 3D printing technology, it is possible to compensate for the low nutrient content in foods and replace the amount of ingredients that cannot be achieved with traditional food processing methods. In this way, it can be used as personalized diets for the elderly, those with special nutritional needs, athletes, military and space meals. 3D printing is used in many foods such as fruits and vegetables, and sweet products, which should have a fresh taste and appearance and long shelf life is required. The shape design and customized nutritional supplement advantages of 3D printing cannot be achieved with conventional machining. With 3D-printed foods, safety problems are eliminated, and food waste and energy consumption are reduced. Although some 3D-printed foods differ in taste from traditional processed foods, this technology provides an advantage by combining a series of time-consuming and laborious processes in one step.

Keywords: *3D printing technology, food formulation, food industry*

Oral Presentation

OPTIMIZATION OF PROCESS PARAMETERS AND MECHANICAL PROPERTY ANALYSIS OF PLA PARTS MANUFACTURED BY FDM USING A GREY RELATIONAL ANALYSIS

Ozhan Kitay[a*], Omer Alaca[b]

[a] Bilecik Seyh Edebali University, Machine and Metal Technologies Department, 11100 Bilecik, TÜRKİYE
[b]Bilecik Seyh Edebali University, Electricity and Energy Department, 11100 Bilecik, TÜRKİYE

ABSTRACT

Additive Manufacturing(AM) methods makes it possible to manufacture complex shaped parts and prototypes with various engineering materials such as ceramics, polymers and metals. One of these AM methods is Fused Deposition Modeling (FDM). The heated filament is extruded from a nozzle and layer by layer production is performed. It is possible to mention many different input parameters in the FDM process, such as the layer thickness, infill %, infill type, temperature, printing speed and other parameters. The selected process parameters directly affect the mechanical properties of the manufactured product. Especially poor and anisotropic mechanical properties can directly affect the usage performance of the parts manufactured by FDM method.In this study, the effects of layer thickness, infill %, infill pattern and printing speed parameters on the tensile properties of FDM parts made of PLA material were investigated and the results were optimized using a Grey Relational Analysis(GRA). The experimental and GRA results showed that the highest tensile strength value was obtained at the lowest layer thickness of 0.1 mm and the highest infill density of 100%. Because lower layer thickness provides higher bonding area between layers and higher infill density ensures less voids between filaments in the inner structure.

Keywords: *Fused Deposition Modeling (FDM). Optimization. Polylactic acid (PLA). Tensile strength. 3D Printing.*

Oral Presentation

THE DESIGN OF THE ORGANIC-STRUCTURED UNMANNED AERIAL VEHICLE BODY PRODUCED BY 3D PRINTING PROCESS USING TOPOLOGY OPTIMIZATION

Mine USLU UYSAL , Nursen KAHVECİ

Yildiz Technical University, Department of Mechanical Engineering, Besiktas, 34349, Istanbul-Turkiye

ABSTRACT

In this study, a suitable body model of an unmanned aerial vehicle with rotary wings and four rotorsis is designed and analyzed. In this design, the aim is to create a rigid body with organic structure with topology optimization using the finite element method. The body, which is optimized by performing static and dynamic analyzes on the design, is produced by choosing a bioplastic material as Polylactic Acid ,PLA.

The body model geometry of the unmanned aerial vehicle was created in the Siemens NX solid modeling program and then transferred to the ANSYS finite element program. The unmanned aerial vehicle body model has been loaded and analyzed with realistic loads (drone battery, drone antenna, dorne weight, etc.). As a result of the static analysis, the stress and displacement values at the current loading condition were noted. Afterwards, with topology optimization, the body model mass was reduced from 3.03 kg to 2.22 kg, and an approximately 27% hollowing in the body was achieved. The new body model, which has been optimized in weight and has a more aesthetic structure, has been analyzed with the finite element method. The stress and strain values resulting from the static analysis in the new model were compared with the initial state and the strength of the new body model was examined. The distribution of von-mises normal stresses on the body and shear stresses on the wings and rotors are discussed on the designed suitable model. Also, the deformation graphics due to loading are given comparatively.

Keywords: *Design modelling and Analysis, 3d Printing (additive manufacturing), Topology optimization, Unmanned aerial vehicle and bioplastic materials (PLA*)

Oral Presentation

ANALYSIS OF DEFECTS DURING THE MANUFACTURING OF LATTICE PARTS BY SELECTIVE LASER SINTERING

Mevlüt Yunus Kayacanr[a*], Mustafa Safa Yılmaz[b], Ahmet Üzün[a]

[a] Isparta University of Applied Sciences, Technology Faculty, Mechanical Engineering Department, TURKIYE
[b] Uludağ University, Engineering Faculty, Mechanical Engineering Department, TURKIYE

ABSTRACT

Metal additive manufacturing methods are preferred in high engineering applications where lightweight and relative strength are required. There are many academic studies and industrial applications, especially in the aerospace industry, with selective laser melting, which is one of the most preferred of these methods. In this study, the problems that may be encountered during the fabrication of lattice structures produced using 316L metal powders were analysed by experimental studies. Cylindrical and prismatic specimens consisting of 5 different topological unit lattice structures were manufactured in 3 repetitions. Internal stresses due to temperature changes during manufacturing, warping of unsupported surfaces and dimensional deviations were analysed experimentally. The bars in the lattice structure placed parallel to the manufacturing table caused serious deformations due to shrinkage. The deformations were clearly visible on the outer surfaces of the parts. As a result of the investigations, the effects of lattice structure parameters on manufacturability were determined. The results obtained are instructive in terms of the use of table positioning angle and radius for the error-free production of lattice structured parts.

Keywords: *Selective Laser Melting, 316L, Lattice Structures, Manufacturing Defects.*

Oral Presentation

A DESIGN FOR ADDITIVE MANUFACTURING METHODOLOGY APPLIED TO BOAT BOW CHOCK

Altuğ Kılıç[1,2], Mehmet Ayaydın[1,3], Ahmet Taşdemir[1,4], Necip Hayran[5], Ali Oğuz[5]

[1]3ASN Arge Tasarım İnovasyon Mühendislik Danışmanlık Ltd. Şti., İstanbul Teknopark, 34906, İstanbul, Türkiye
[2]Department of Mechanical Engineering, Piri Reis University, 34940, İstanbul, Türkiye
[3]Department of Mechanical Engineering, Yıldız Technical University, 34349, İstanbul, Türkiye
[4]Department of Marine Engineering, Piri Reis University, 34940, İstanbul, Türkiye
[5]Promakim Boya Reklam Makina Sa. Tic. A.Ş., İstanbul Teknopark, 34906, İstanbul, Türkiye

ABSTRACT

The advent of additive manufacturing (AM) has revolutionized traditional manufacturing processes, enabling new design possibilities and opening doors to innovative applications in maritime industry. This study highlights the significance of design considerations, optimization techniques, and generative design methods in the realm of additive manufacturing. Design for Additive Manufacturing (DfAM) is a critical aspect that encompasses the integration of AM technologies into the design process. By understanding the unique capabilities and constraints of additive manufacturing, designers can optimize part geometries, reduce material waste, and exploit the inherent freedom of design offered by this manufacturing method. In this study, a boat bow chock was designed for AM and printed by Continuous Fiber Fabrication (CFF) method. For the optimization of the design, Generative Design (GD) method was used, and the optimized designs were analyzed in terms of stress distribution by Finite Element Method. All design solutions suitable in terms of mechanical stresses were analyzed according to printability with CFF (e.g., printing direction, need of support structure, part positioning etc.). During the generative design, the weight of the part was decreased from 1 kg to around 300 g without decreasing the strength-to-weight ratio dramatically. A minimum safety factor of 2 was used in finite element calculations. The final design was first printed by a material (e.g., SLA, ABS etc.) to optimize the printing parameters and support structures. After the verification of the printing process, carbon fiber filament was used for the fabrication of final parts.

Keywords: Design for additive manufacturing, Fused Deposition Modeling (FDM), Ship parts, Generative design, Prototyping, Carbon fiber filament

Oral Presentation

EVALUATION OF POST-PROCESSING ON THE CORROSION BEHAVIOUR OF ALSI10MG BY SELECTIVE LASER MELTING PROCESS

Ahu CELEBI[1] Semih CETINKAYA[1]

[1] *(Manisa Celal Bayar University, Turkey)*

ABSTRACT

In this study, the microstructural, mechanical and corrosion properties of AlSi10Mg produced by selective laser melting (SLM) and casting method. The effects of heat treatment at 300°C and 400°C for 5 hours are discussed as well. Horizontal and vertical printing provides microstructural and mechanical effects depending on the direction. In order to see this effect, the samples produced by the Selective Laser Melting method were printed both horizontally and vertically and compared with the casting samples. The microstructures were investigated using X-Ray diffractometry (XRD, Energy diffuse X-Ray analysis (EDX) and Scanning electron microscopy (SEM). Electrochemical corrosion testing was performed. Annealing heat treatment causes significant changes of the microstructure and hardness properties. The sample produced by SLM has better hardness values than the conventional cast sample. Fine microstructure and homogenously dispersed Si particles formed during rapid solidification and cooling of the SLM process provide better mechanical properties than typical methods.

Keywords: *Metal additive manufacturing; selective laser melting; AlSi10Mg alloys; mechanical properties of aluminium alloys.*

Oral Presentation

INVESTIGATION OF THE MECHANICAL PROPERTIES OF TI6AL4V ALLOY FLEXURAL TEST SAMPLES FABRICATED BY ELECTRON BEAM MELTING METHOD

Burak Sıcakdemit[a], Arda Pazarcıkcı[a], Koray ÖZSOY[b]

[a]Isparta University of Applied Sciences, Technology Faculty, Mechatronics Engineering Department, TURKIYE
[b]Isparta University of Applied Sciences, Isparta OSB MYO, Machine and Metal Technologies, TÜRKİYE

ABSTRACT

The present study, the effect on the mechanical properties of Ti-6Al-4V alloy was investigated by depending the sample placing orientations angles by EBM methods. The aim of this study is to investigate the mechanical properties of the flexural samples obtained by placing a standard flexural sample size Ti-6Al-4V alloy in different orientations on the manufacturing table by analyzing the results. In this study, six test flexural samples placed in different orientations were fabricated by powder bed fusion(PBF) electron beam melting using Ti-6Al-4V alloy. After then, three of manufactured samples were heat treated. In the experiments, Shimadzu AGS-X (10 kN) machine was used for flexural test. The results showed that the flexural strength of Ti6Al4V alloys varies depending on the orientation of the samples. In addition, the effect of heat treatment on flexural strength was investigated. The obtained findings were compared with the literature.

Keywords: *Additive manufacturing, Electron Beam Melting, Flexural Test, Ti-6Al-4V.*

Oral Presentation

DEVELOPMENT OF LOW AND HIGH PRESSURE COMPONENTS AS A SINGLE PRODUCT

Hakan Maden[a*], Bilal Özsarıkaya[a], Mustafa Kocer[b]

[a] İhlas Ev Aletleri İML. San. Tic. A.Ş., TURKEY

ABSTRACT

Low and high pressure components are used in water purification devices. The low pressure component does not supply electricity to the system since its pressure in the network is under the determined pressure. The high pressure component cuts off the electricity when the clean water tank reaches the specified pressure. Since the low and high pressure components are joined separately in the production line, the production time and cost increase. The low and high pressure components used in the current system are examined. When we bring the two components together, it is thought to use the same internal parts used in the current system. After the determination of the parts to be used, concept designs were made. Concept tracking and scoring matrix will be applied to the concept designs. Then a concept will be decided. Decided concept design; engineering design, prototype production and other parts will be assembled on the prototype part. Tests and controls will be carried out on the prototype product. After successfully passing the tests and controls, it is aimed to make injection molds and start mass production.

Keywords: *Low pressure component, high pressure component, water purifier, concept design*

Oral Presentation

DESIGN AND PHYSICAL PROPERTY EVALUATION OF PROTOTYPE MODELS PRODUCED WITHIN THE SCOPE OF THE TEACHERS' 3D MATERIAL JOURNEY PROJECT

Ayşegül Aslan[a*], Mustafa Aslan[b,c], Kutay Çava[b,c], İrem Özpınar[b]

[a]Trabzon University, Fatih Faculty of Education, Department of Mathematics and Science Education, TÜRKİYE
[b]Karadeniz Technical University, Faculty of Engineering, Department of Metallurgy and Material Engineering, TÜRKİYE
[c]Karadeniz Technical University, Medical Device Design and Production Application and Research Center, METAM, TÜRKİYE

ABSTRACT

The TUBITAK-1001 project is currently underway, focusing on the design and production processes of 3D models. The project is based on the concept that integrating 3D printer technology and 3D models into educational processes can enhance the teaching of challenging subjects and concepts, which are often difficult for students to grasp and for teachers to effectively convey. The sample group for the project consists of 5 biology, 4 physics, and 4 chemistry teachers. The purpose of this study is to evaluate the prototype models designed and developed by the teachers in accordance with the project's "Prototype Model Development" work package in terms of their design and physical properties. Evaluation was done using the "Model Evaluation Rubric" with a maximum score of 32 for physical properties and 60 for design properties. The models with the highest scores in the physical properties dimension were the "Polymerization" model in chemistry (27), the "Chromosome" model in biology (27), and the "Single-Double Slit" model (28). In the design properties dimension, the "Polymerization" model in chemistry (32), the "Enzyme-Substrate" model in biology (35), and the "Energy Conversion Ramp" model in physics (35) had the highest mean scores. In the process of creating prototype models, teachers rated color and texture low in terms of physical properties; in terms of design properties, the models were scored low in terms of criteria such as visual harmony and aesthetics and attracting attention from the student's point of view. It has been observed that the criteria for which high scores are obtained in terms of physical properties are size and weight, and conformity with reality in terms of durability and form in terms of design features.

Keywords: *3D printing technology, prototype model, rubric, design and physical properties, teacher education*

Oral Presentation

ADDITIVE MANUFACTURING OF CONCRETE STRUCTURES AND CONCRETE ELEMENTS, OPTIMIZATION OF THE TIME CONSUMED

Y. Cengiz Toklu, Ali Erdem Çerçevik

ABSTRACT

Using 3D printing technology in the construction industry is a rapidly developing innovative technology with important cost and time advantages. The technology consists of building walls and structural components starting at the bottom and progressing up in concrete layers. The structure thus obtained may be reinforced or not, according to the procedure chosen. 3D printing technology seems to have an important area of applications in areas where time is restricted, as in disaster areas, and also in harsh areas where use of manpower is dangerous, as in space and on space bodies. In this study generalities of this technique are given followed by applications of an optimization process to minimize the time necessary for molding a structure. The optimization process consists of an application of a metaheuristic algorithm, namely harmony search. It is shown that as the structure becomes more complicated, optimization becomes more and more time-consuming, but the advantage of this process is very important.

Oral Presentation

DESIGN, MANUFACTURING AND FINITE ELEMENT ASSESSMENT OF FUNCTIONALLY GRADED AUXETIC STRUCTURES

Mert ÖZEN, Lect. PhD Hamit KENAN, Assoc. Prof. Cumhur Oktay AZELOĞLU

Faculty Of Mechanical Engineering, Deparment Of Mechanical Engineering, Construction

ABSTRACT

The development of structures that aim to achieve lightweight designs while meeting desired mechanical properties has gained significant importance with advancements in manufacturing technologies. Researchers have been particularly focused on exploring such structures, aided by the capabilities of additive manufacturing methods, which allow for rapid prototyping and testing of new designs. One topic of discussion in this field is auxetic structures, which exhibit unique characteristics such as expansion under tension and contraction under compression, displaying a negative Poisson's ratio. The advantages offered by auxetic structures, including enhanced energy absorption, increased flexibility and range of motion, improved mechanical properties, as well as improved harmony, comfort, filtration, and insulation, have led to their preference and ongoing development.

This study aims to generate novel designs by employing the functional grading approach in auxetic structures. A functionally graded structure (FGS) refers to a material system in which mechanical, thermal, or electrical properties change gradually and continuously in a controlled manner throughout the volume of the structure. Accordingly, auxetic structures capable of adapting to the functional grading approach will be selected. These structures will be modeled using the finite element method, and preliminary simulation studies will be conducted to determine their mechanical properties. Designs that demonstrate positive contributions in terms of mechanical properties will be fabricated using polymer-based PLA (Polylactic Acid) material and additive manufacturing methods.

The resulting specimens, manufactured through additive manufacturing, will undergo standard test procedures, including tensile, compression, and three-point bending tests. These experiments will provide valuable data for determining the mechanical properties of the fabricated auxetic structures. Furthermore, a theoretical model will be developed, which will be validated through experimental comparisons. This model will enable conducting various tests with different scenarios solely through theoretical analysis, eliminating the need for physical experiments on similar structures.

Keywords: *Auxetic structure, Functionally graded structure, Additive Manufacturing, Finite Element Analysis.*

Oral Presentation

THE SYSTEMATIC REVIEW OF THE STUDIES CONDUCTED IN TURKEY ON THE TOPIC OF APPLYING 3D PRINTING IN MATHEMATICS EDUCATION

Ayça AKIN[a*], H. Seda SEZGİN[b]

[a]Antalya Belek University, Engineering Faculty, Sofware Engineering Department, TURKEY
[b]Ministry of Education, TURKEY

ABSTRACT

3D printing technology is increasingly widely used in all areas of STEM education. Many researchers emphasize that 3D printing in the context of mathematics education unpacks students' mathematical and design thinking, as well as helps them develop spatial skills, and is a key tool for visualizing mathematical concepts, especially in calculus and geometry. However, as far as we have examined the literature, there is no existing systematic review that comprehensively describes and synthesizes the findings in the literature on how 3D printing is applied in mathematics education in the context of studies conducted in Turkey. The purpose of this research is to make a systematic review of the studies conducted between 2015-2023 in Turkey on the topic of applying 3D printing in mathematics education. The results of this study that the qualitative research method was preferred more in these studies. The most frequently used dependent variable in these studies is mathematics achievement, and the participants of the studies were mostly middle school students in these studies. The results of this systematic review indicated that applying 3D printing in mathematics instruction usually helps to improve students' mathematical literacy, and mathematical skills in the context of studies conducted in Turkey.

Keywords: *3D Printing. Mathematics Intervention. Educational Technology. Mathematical Reasoning. Spatial Skills*

Oral Presentation

THE EFFECTS OF INTER LAYER PRESSURIZED AIR COOLING ON MECHANICAL PROPERTIES AND MICROSTRUCTURE OF THIN WALL MANUFACTURED BY CMT WAAM

Gökçe EKEN[1], Tolga MERT[2]

[1] Undergraduate student, Yildiz Technical University, Dep. of Mechanical Engineering, Yildiz/Besiktas-Istanbul
[2] Assoc. Prof. Dr., Yildiz Technical University, Dep. of Mechanical Engineering, Yildiz/Besiktas-Istanbul

ABSTRACT

Additive manufacturing (AM) technologies became popular in the recent past due to their benefits such as fast processing, high accuracy even in complex geometries and less material consumption than machining. Most of the AM technologies utilize powder as a feedstock, whilst wire arc additive manufacturing (WAAM), which is a direct energy deposition (DED) technique, uses welding wire. WAAM decreases manufacturing and post process times between 15%-60% and to perform the process, it does not need a special environment such as a cabinet. These features make WAAM suitable for production of high numbers and bigger products. CMT is a technique which is based on short circuiting and rapid retraction and feeding of the wire and this process decreases spatter, heat input and provides a better finish and more control on the process. Continuous heat input and as a result of heat accumulation in WAAM might lead to an overflow especially in upper welding passes (layers). Cooling can be applied to mitigate this defect and improve manufacturing rate.
In this study, the effects of inter layer cooling via pressurized air application on mechanical properties and microstructure of thin wall manufactured by CMT WAAM process using SG2 unalloyed welding wire were investigated.

Keywords: *CMT WAAM, unalloyed steel, inter layer cooling, pressurized air, tensile strength, hardness, microstructure*

Oral Presentation

RADIOLOGICAL EVALUATION OF THE EFFECTS OF INFILL DENSITY ON 3D PRINTED PLA SAMPLES

Deniz KISINMA AZAKLIOĞLU[a*], Songul ÇAVDAR KARAÇAM[a], Nural PASTACI ÖZSOBACI[b], Derviş ÖZÇELİK[b]

[a]Istanbul University- Cerrahpasa, Medicine Faculty of Cerrahpaşa, Department of Radiation Oncology, Istanbul, TURKEY
[b]Istanbul University- Cerrahpasa, Medicine Faculty of Cerrahpaşa, Department of Biophysics, Istanbul, TURKEY

ABSTRACT

3D printing materials are producued different filaments and infill densities, radiologically tissue equivalent structures are recommended. Polylactic Acid (PLA) is one of the filaments mainly used to simulate soft tissue with infill densities between 80% - 100%. PLA with density of 1.25 g/cm^3 and 100% infill density is applied for this work to soft tissue surrounding air cavity and bone tissue. 5 different infill ratios; 0%, 10%, 20%, 40%, and 100% are printed to determine better soft tissue results. The dimensions of 5x5x1 cm^3 samples are evaluated using Hounsfield Units called the grey scale. Grayscale values can be obtained when scanning with computed tomography (CT). CT (GE, General Electric Discovery RT) was used to evaluate HU values. CT images were exported to Eclipse V15.6 TPS (Varian Medical Systems, Palo Alto, CA), each process was done and HU was collected. It can be noticed that there is suitable correlation with the 100% infill ratio and the ideal soft tissue HU is 0.
Mean HU value of 28 and 23; BT and TPS respectively are acceptable to use PLA for soft tissue with 100% infill ratio. It can be seen that the differnce of 5 HU saved between BT and TPS, which is acceptable. PLA with 100% infill ratio corresponds the demands on material for soft tissue.

Keywords: *PLA, infill ratio, Hounsfield Unit*

Oral Presentation

DOSIMETRIC EVALUATION OF PLA AND ABS MATERIALS PRODUCED BY TWO DIFFERENT PRODUCTION TECHNIQUES

Songül ÇAVDAR KARAÇAM[A*], Duygu TUNÇMAN[b], Tülin ŞAHİN[c], Şenol ŞAHİN[c], Şefika Arzu ERGEN[a], Meltem Dağdelen[a], Ömer Erol Uzel[a], Didem ÇOLPAN ÖKSÜZ[a]

[a]Istanbul University- Cerrahpasa, Cerrahpasa Medicine Faculty, Radiation Oncology Department, Istanbul, TURKEY.
[b]Istanbul University- Cerrahpasa, Vocational School of Health Services, Radiotherapy Program, Istanbul, TURKEY.
[c]Kocaeli University, Mechanical Engineering Department, Izmit,TURKEY.

ABSTRACT

In recent years, polymer materials have become a wide range of scientific research in radiotherapy. Especially PLA (Polylactic Acid), and Acrylonitrile Butadiene Styrene (ABS) materials are widely used in the field of various radiotherapy applications. 3D printing was the first of these technologies, but the technology of plastic injection molding technology has also been used in manufacturing for many years. Firstly, the 3D printing of ABS and PLA materials was printed on the Ultimaker S5 model 3D printer. ABS and PLA materials in the form of square prisms, 12x12x1 cm^3 in size, were produced in order to be suitable for measuring instruments for radiation measurements. Then the test materials were produced by direct injection molding in an ISO D2 type mold made of S235JR steel (material number 1.0038) with the same dimension. It was aimed at dosimetric evaluation of the response of these materials to radiation, produced by 3D and plastic injection molding techniques. Hounsfield Units (HU) values were determined with the CT simulator device for materials produced from both techniques. Dosimetric measurements were made using the 6 MV nominal photon energy obtained in the Varian DHX linear accelerator. The radio transmittance measurements of the materials were performed in a solid water phantom. Although the dosimetric parameters of the materials produced in the 3D printer and plastic injection method give similar results, it seems appropriate to evaluate the material to be used dosimetrically before being used as personal material on the patient due to the printing characteristics and material variability.

Keywords: *3D Printer, radiotherapy, dosimetry.*

Oral Presentation

DEVELOPMENT AND DOSIMETRIC VERIFICATION of 3D MOULD APPLICATOR IN BRACHYTHERAPY

Songül ÇAVDAR KARAÇAM[a*], Duygu TUNÇMAN[b], Meltem DAĞDELEN[a], Ömer Erol UZEL[a]

[a]Istanbul University- Cerrahpasa, Cerrahpasa Medicine Faculty, Radiation Oncology Department, Istanbul, TURKEY.
[b]Istanbul University- Cerrahpasa, Vocational School of Health Services, Radiotherapy Program, Istanbul, TURKEY.

ABSTRACT

Various applicators are used in brachytherapy to guide the radioactive sources to the patient in a stable way. In literature, the applicators used do not fit the curved areas of the body and create an air gap with the body surface. The purpose of this study was to evaluate the feasibility of using a patient-specific 3 Dimensional (3D) mould applicator from Polylactic Acid (PLA) material. In this study, the 3D mould applicator was printed at the ear and cheek regions. A 12x12x1 cm^3 PLA sample was printed using an Ultimaker S5 model 3D printer. Printer accuracy was investigated through physical measurements. The dosimetric consequences of the printing % 100 infill percentage were analysed experimentally by measuring mean HU values, depth dose curves (%PDD), and profiles. Hounsfield Unit (HU) values were determined in a CT simulator device. Dosimetry measurements were performed at 6 MV generated by a Varian Clinac DHX linear accelerator using a water phantom. In addition, the radiation transmittance measurements were performed in a solid water phantom. Mean HU for PLA was measured between -8.63-.17 HU for PLA, while STD values were measured between ±13.45 HU. We analyzed PLA material by comparing the bolus material. Dose differences for these materials were within ±2% beyond the build-up region for PDD values and within ±1.0% for transmittance dose values.
Overall, the PLA 3D moulded applicator provide viable dosimetric properties and cost saving compared to commercially available applicators. The 3D mould applicator may improve treatment efficiency and may be an alternative

Keywords: *3D Printer, Brachytherapy, Applicator*

Oral Presentation

INVESTIGATION OF THE COMPRESSION BEHAVIOR OF THE ADDITIVELY MANUFACTURED GLASS-FIBER REINFORCED COMPOSITES VIA VAT-PHOTOPOLYMERIZATION

Kutay Çava[a, b], Hüseyin İpek[a, b], Altuğ Uşun[b, c], Hüseyin Can Aksa[a, b], Mustafa Aslan[a, b*]

[a]Karadeniz Technical University, Faculty of Engineering, Department of Metallurgy and Material Engineering, TÜRKİYE
[b]Karadeniz Technical University, Medical Device Design and Production Application and Research Center, TÜRKİYE
[c]Karadeniz Technical University, Faculty of Engineering, Department of Mechanical Engineering, TÜRKİYE

ABSTRACT

At present, additive manufacturing has become increasingly popular across various industries such as automotive, aerospace, and medical applications. While this technology offers enhanced design flexibility, they lack mechanical properties and production speed according to the traditional manufacturing methods. Therefore, in this study, the manufacturing of glass fiber woven fabrics with VAT-photopolymerization printing to produce composite parts with enhanced mechanical properties were investigated. Utilization of this method allowed manufacturing of composites with increased manufacturing speeds compared to the conventional methods. Manufactured samples were parametrically investigated by using different stacking sequences and fiber fractions. The mechanical properties of the printed parts were thoroughly examined through compression tests. Maximum compression strength was obtained at 151.82 MPa in $(0,90)_{x4}$-16 samples with 32% fiber volume. The findings of the study indicate that the use of glass fiber woven fabric in VAT printing holds promise to produce composite parts with improved mechanical properties. By incorporating the glass fiber woven fabric into the VAT printing process, it becomes possible to achieve composite parts that exhibit enhanced strength and performance characteristics, making it an attractive alternative to traditional composite manufacturing methods.

Keywords: *VAT-Photopolymerization. Glass Fiber Composites. Mechanical Properties. Additive Manufacturing. Compressive Behavior.*

Oral Presentation

PRODUCTION OF A PERSONALIZED MANDIBLE PROSTHESIS FROM CT IMAGES USING THE POWDER BED FUSION PROCESS METHOD

Hüseyin Can Aksa[a, b], Kutay Çava[a, b], Altuğ Uşun[b, c], Hüseyin İpek[a, b], Mustafa Aslan[a, b*]

[a]Karadeniz Technical University, Faculty of Engineering, Department of Metallurgy and Material Engineering, TÜRKİYE
[b]Karadeniz Technical University, Medical Device Design and Production Application and Research Center, TÜRKİYE
[c]Karadeniz Technical University, Faculty of Engineering, Department of Mechanical Engineering, TÜRKİYE

ABSTRACT

In recent years, computed tomography (CT) imaging techniques have played a significant role in designing personalized prostheses which are dental devices used in cases of mandible loss or deformation. These techniques provide data to analyze the patient's mandible structure in detail and design a customized mandible prosthesis based on that information. CT images are used to create a three-dimensional model of the patient's mandible structure. This model visualizes the shape, dimensions, and other anatomical details of the mandible bones. In this study, the processing and analysis of these images are done using Materialise Mimics and a computer-aided design (CAD) software Materialise 3-Matic. The designed prosthesis manufactured using a selective laser melting (SLM) device with 20 µm layer thickness using Titanium – 6 Aluminum – 4 Vanadium (Ti-6Al-4V) material which is proven to be biocompatible in the literature and medical applications. The size range of Ti-6Al-4V grade 23 powders used in our study is 15-53 µm and they have a spherical morphology. Personalized mandibular prosthesis, which was specially designed for the persons specific bone structure was produced using this method. To reduce the surface roughness, the produced prothesis was polished as a post-process.

Keywords: *VAT-Photopolymerization. Glass Fiber Composites. Mechanical Properties. Additive Manufacturing. Compressive Behavior.*

Oral Presentation

TIME AND COST EVALUATION OF THE USE OF FILAMENT AND GRANULE MATERIAL IN POLYMER MATERIAL FED ADDITIVE MANUFACTURING TECHNOLOGY

A. Köbeloğlu, K. Çetinkaya, S. Altun,

ABSTRACT

Mainly, filament-fed systems are used in Fused Deposition Modeling (FDM)3D printer machines. Granule material-fed systems are preferred in large-scale industrial 3D printers. In this study, the production costs and printing times of a part by using filament-fed and granule material-fed systems in 3D printers were examined. Polylactic acid (PLA) filament and PLA granule material were used as polymers. The findings obtained as a result of the study were discussed.

Keywords: *Additive manufacturing, Fused deposition modeling, Filament feeding, Granule material feeding, production cost*

Oral Presentation

NUMERICAL AND EXPERIMENTAL INVESTIGATION ON MECHANICAL PROPERTIES OF GYROID-BASED LATTICE STRUCTURES WITH DIFFERENT CELL ORIENTATIONS

Golbarg Nikaeen[a], Mohammad Hossein Sadeghi[a*], Maryam Jamshidi[a], Binnur Sagbas[b]

[a]Tarbiat Modares University, Mechanical Engineering Faculty, Mechanical Engineering Department, IRAN
[b]Yildiz Technical University, Mechanical Engineering Faculty, Mechanical Engineering Department, TURKEY

ABSTRACT

Lattice structures are usually anisotropic due to the non-uniform distribution of the constitutive material. Therefore, loading direction can have a significant effect on the mechanical response of a lattice structure. Bone scaffolds are usually subjected to complex and sometimes unknown loading conditions. Therefore, in a lattice scaffold, these loads are not necessarily along the principal axis of the tessellated unit cells. Accordingly, it is worth choosing the proper cell orientation angle in order to achieve a better mechanical response. This study has focused on the mechanical properties of Gyroid-based lattice structures with different cell orientations. Five Gyroid-based lattice models with different cell orientations were numerically analyzed. Experiments were also conducted on corresponding samples manufactured by a liquid crystal display (LCD) 3D printer. Results showed that the difference between Young's modulus in the stiffest and least stiff directions is 18.99%. This can be considered as an advantage for developing bone regeneration scaffolds especially when loading directions are unknown.

Keywords: *Gyroid Lattice Structure. Cell Orientation. Lattice Scaffold.*

Oral Presentation

BENDING BEHAVIOUR OF ADDITIVELY MANUFACTURED GYROID-BASED LATTICE BEAMS

Saeed Kazemivand[a], Golbarg Nikaeen[a], Mohammad Hossein Sadeghi[a*], Bahattin Koc[b]

[a]Tarbiat Modares University, Mechanical Engineering Faculty, Mechanical Engineering Department, IRAN
[b]Sabanci University, Engineering and Natural Sciences Faculty, Manufacturing Engineering Department, TURKEY

ABSTRACT

In recent years, lattice structures have received much attention due to their special characteristics, which mainly depend on their microarchitecture. These structures have a broad range of applications in different fields of engineering, especially in the biomedical field and more precisely in developing orthopedic implants and bone scaffolds. An orthopedic implant is subjected to various loadings according to the anatomical position where it is implanted and the function it should perform. A complex loading condition can include force components that lead to bending, twisting, and buckling in the implant structure. The purpose of this study is to investigate the bending behavior of sheet-based Gyroid beams. Four Gyroid lattice beams were prepared using stereolithography apparatus (SLA). The bending rigidity of each beam was obtained through mechanical compression tests. The obtained results were compared to the bending rigidity calculated using the Euler-Bernoulli beam theory. Results showed that although the classical beam theory cannot predict the exact behavior of the lattice beam in small thicknesses, it can estimate it with a little inaccuracy.

Keywords: *Gyroid Lattice. Gyroid Lattice Beam. Beam Theory.*

Oral Presentation

MANUFACTURING OF GYROID-BASED LATTICE STRUCTURES USING A COMBINED METHOD OF INVESTMENT CASTING AND ADDITIVE MANUFACTURING

Hassan Heydari[a], Golbarg Nikaeen[a], Mohammad Hossein Sadeghi[a*]

[a]Tarbiat Modares University, Mechanical Engineering Faculty, Mechanical Engineering Department, IRAN

ABSTRACT

Nowadays, the use of lattice structures in orthopedic implants and bone scaffolds is of great importance. A lattice implant has a decreased stiffness in the range of that of natural bone tissue. So, it can prevent the stress shielding effect. Furthermore, it causes bone growth at the bone-implant interface. Usually, these structures are made through metal additive manufacturing methods like Selective Laser Melting (SLM) or Electron Beam Melting (EBM) which can prepare complex geometries easily. However, these methods have some limitations which can be mentioned as follows: metallurgical defects, high production costs, relatively low manufacturing efficiency, limitation in choosing alloys, and limitations in the dimensions of the intended part. The purpose of this study is to prepare Gyroid lattice structures using the combined method of investment casting and additive manufacturing. The wax model was additively manufactured using Digital Light Processing (DLP) and then it was placed in a special mold. After heating the mold, the melted wax model came out of the mold. The remaining cavity was filled with metal and after cooling the mold, the final part was removed. Results showed that this combined method can be a reliable method to make these lattice parts with relatively fine features and it can be an affordable alternative to the additive manufacturing method.

Keywords: *Investment Casting of Lattice Structures. Gyroid Lattice Structure. Investment Casting.*

Oral Presentation

INVESTIGATION OF MECHANICAL PROPERTIES AND MICROSTRUCTURES OF THREE DIFFERENT BIOCOMPATIBLE CO-CR ALLOYS PRODUCED BY LASER POWDER BED FUSION

Ress. Asst. Muhammed Taha YILDIZ[a] , Assoc. Prof. Nazım BABACAN[a]

[a]Sivas University of Science and Technology, Faculty of Engineering and Natural Sciences, Mechanical Engineering Department, TÜRKİYE

ABSTRACT

Laser powder bed fusion (LPBF) systems have been widely used in recent years to produce parts with high complexity and personalized designs. Nickel-free Co-Cr alloys produced by LPBF are commonly used in the dental field due to their high wear resistance, high temperature strength, corrosion resistance, and biocompatibility. This study focused on fabricating cylindrical tensile test specimens and small samples for microstructural investigations using three different Co-Cr based alloys (Co-Cr-Mo, Co-Cr-W, Co-Cr-Mo-W) through the LPBF method. Throughout the production process, the laser power (180 W), scanning speed (600 mm/s), hatch distance (70 µm), and layer thickness (30 µm) were kept constant for all three alloys. After production, heat treatment at 750° C for 1 hour was applied to all of the samples. Eight cylindrical tensile specimens were produced for each alloy and tested using a universal tensile testing machine. Among the heat-treated specimens, the Co-Cr-W alloy exhibited the highest yield strength (1066 ±41 MPa) and the highest tensile strength (1258 ±14 MPa), while the Co-Cr-Mo alloy achieved the highest elongation percentage (8.4 ±0.9 %). Microstructural observations made using optical and scanning electron microscopes showed the presence of meltpool boundaries in all alloys even after heat treatment, with different types of precipitation formation.

Keywords: *Co-Cr alloys. Additive Manufacturing. Laser Powder Bed Fusion. Tensile Mechanical Properties. Microstructure.*

Oral Presentation

INVESTIGATION OF PORCELAIN BOND STRENGTH OF METAL FRAMEWORKS PRODUCED BY SLM AT DIFFERENT LASER POWERS

Betül KARAHASAN[a*], Derya ÖZDEMİR DOĞAN[b], Nazım BABACAN[c]

[a]Ress. Asst., DDS, Sivas Cumhuriyet University, Faculty of Dentistry, Department of Prosthetic Dentistry, TURKEY
[b]Prof. Dr., Sivas Cumhuriyet University, Faculty of Dentistry, Department of Prosthetic Dentistry, TURKEY
[c]Assoc. Prof., Sivas University of Science and Technology, Faculty of Engineering and Natural Sciences, Mechanical Engineering Department, TURKEY

ABSTRACT

In today's technology, selective laser melting (SLM) technology is replacing the casting method in the production of metal frameworks for dental restorations. Modifying the processing parameters in the SLM method impacts the metallographic and surface characteristics of the metal structure, consequently influencing the bonding strength of the porcelain applied onto it. This study aims to establish the correlation between the surface properties of Co-Cr alloy fabricated through SLM, employing various laser power settings, and the bonding strength of porcelain to the alloy.

Laser power was selected as 240 W, 300 W, 360 W in 3 groups; productions were carried out with a laser scanning speed of 500 mm/s, a layer thickness of 30 µm, and a hatch distance of 100 µm. To determine the relative density, samples with 12x12x10 mm^3 dimensions were fabricated. Additionally, rectangular plates with dimensions of 25x3x0.5 mm^3 were produced for the purpose of conducting the 3-point bending and surface roughness tests. The Archimedes' principle was employed to calculate the relative density of the samples, while an optical profilometer was used to measure the surface roughness. Subsequently, the porcelain bond strength was evaluated through a 3-point bending test conducted after the porcelain was fused onto the samples.

Despite the samples having nearly identical relative density (approximately 99.2%), the 360 W group exhibited the highest porcelain bond strength and surface roughness. This finding suggests that the increased surface roughness contributes positively to the porcelain bond strength, possibly due to enhanced micromechanical locking.

Keywords: *Co-Cr alloys. Selective Laser Melting. Bond Strength. Laser Power. Surface Roughness.*

Oral Presentation

HOMOGENIZED PROPERTIES OF PERIODIC LATTICE MATERIALS

Mehmet DEMİRTUNÇ[a], Recep M GÖRGÜLÜARSLAN[a]

[a]Department of Mechanical Engineering, TOBB University of Economy and Technology, Cankaya, Ankara

ABSTRACT

The use of lattice structure is remarkable in many industries due to its lightweight but stiff property. The complex topology of these structures can be fabricated by additive manufacturing. While using Lattice materials, it is important to choose the most efficient lattice material according to the structural situation. Structural analysis processes must be completed to understand the structural properties of lattice materials. In this paper, structural properties of many types of lattice materials are compared by taking into account their effective mechanical properties and anisotropy ratios. However, structural analysis of lattice materials is difficult in terms of computational cost and mathematical modeling because they are very complex structures. Instead of modeling complex structures, numerical homogenization method is used. The homogenization method is a method based on making an approximation of the mechanical properties of lattice materials with a solid material by modeling with representative volume elements. In this paper, periodic lattice materials with cubic symmetry are represented by numerical homogenization method and the obtained Young's modulus, shear modulus and Zener ratios are compared and interpreted to select the lattice type which gives best performance and lowest anisotropy.

Keywords: *Lattice material, Additive Manufacturing, Homogenization*

Oral Presentation

A NEW INDUSTRIAL MICROWAVE-ASSISTED DISTILLATION SYSTEM FOR ESSENTIAL OIL EXTRACTION FROM MEDICINAL AND AROMATIC PLANTS

Habib Dogan[a, *], Ahmet Faruk Temiz[b], Abdullah Genc[b]

[a]Burdur Mehmet Akif Ersoy University, Gölhisar School of Applied Sciences, Department of Computer Technologies, and Information Systems, Gölhisar, Burdur, TURKEY
[b]Isparta University of Applied Sciences, Faculty of Technology, Department of Mechatronics Engineering, Isparta, TURKEY

ABSTRACT

Essential oil extraction from medicinal and aromatic plants is an area that requires consideration and continuous improvement of its processes as it results in high-value-added products in the industrial sense. The fact that our country, Turkey has a very high richness in terms of these products makes it necessary to increase the efficiency of these processes. Isparta, Burdur Antalya region, called TR61 region, is the region where this diversity is the most widespread in our country. The continuation of distillation processes in this region with traditional methods negatively affects both product yield and energy consumption. According to studies in the literature, microwave-assisted systems are more advantageous than traditional systems. In this study, a new industrial microwave-assisted distillation system is proposed to obtain essential oil from medicinal and aromatic plants. In the traditional distillation system, the oils of the plants are obtained by steam applied into the boiler. In the microwave-assisted distillation system, both steam and electromagnetic field are applied to the boiler and this method is more advantageous in terms of both oil yield and time. Before the physical realization of the system, the effect of the 2.45 GHz electromagnetic field applied by the magnetron is obtained through the simulation program. When the tests of the proposed system are completely completed, the optimization processes of the microwave-assisted distillation system for lavender, thyme, sage, and laurel plants, which are intensively produced in TR61 region, will be completed. In this optimization process, the results of the GC-MS tests of the essential oils taken at each measurement will be considered.

Keywords: *Distillation. Microwave. Magnetron. Optimization. Essential oil.*

Oral Presentation

GAS ATOMIZATION OF Ni-HARD POWDER

Onur MURATAL[a*], Rıdvan YAMANOĞLU[a], Can DURAN[a], Yiğit GÖNÜLALAN[a], Yağız AKYILDIZ[a], Funda GÜL KOÇ[b], Burak BARUTÇUOĞLU[b]

[a]Kocaeli University, Engineering Faculty, Metallurgy and Materials Department & TOYOTETSU OTOMOTIV, TURKEY
[b]Kocaeli University, Engineering Faculty, Metallurgy and Materials Department, TURKEY
[b]Kocaeli University, Engineering Faculty, Metallurgy and Materials Department & ONATUS Öngörü Teknolojileri, TURKEY

ABSTRACT

Ni-Hard cast iron materials are frequently used in equipment where high wear resistance is required in industrial applications. Generally, Ni-Hard cast iron materials are produced by conventional casting techniques. In this study, it is aimed to produce Ni-Hard powders in order to produce Ni-Hard cast iron materials with additive manufacturing techniques. To produce spherical and fine powders for additive manufacturing techniques, the gas atomization technique with a close-coupled nozzle system was preferred for the production of Ni-Hard powders. Ni-Hard cast iron materials were melted in a high-frequency induction furnace under a protective atmosphere integrated into the gas atomization system. During the atomization process, 150°C superheating was applied to prevent the liquid metal from freezing and clogging the melt delivery tube. In terms of the continuity of the atomization process, the negative pressure (aspiration pressure) values formed at the end of the melt flow tube at different gas pressures were measured. An aspiration pressure of -50 mbar was obtained under an atomization pressure of 35 bar. Particle size distributions, hall flow behaviour and angle of repose of the produced powders were determined. Then, the characterization of the powders was carried out by scanning electron microscopy.

Keywords: *Gas Atomization, Additive Manufacturing, Ni-Hard, Powder Characterization*

Oral Presentation

INVESTIGATION OF ULTEM 9085 MATERIAL REINFORCEMENT WITH NYLON12-CF MATERIAL COMPONENTS

Onur,Konan*; Ataberk,Yapici; Okan,Gümüşel

ABSTRACT

Due to the regulations applied in the aviation industry, it is mandatory to have non-flammability certificates for the polymer materials used. The commercial name of the most widely used non-flammability certified material in the additive manufacturing method working with extrusion is Ultem 9085. However, due to the application in which it is used, the rigidity of this material may be insufficient. In this study, in order to increase the rigidity of Ultem 9085 material, it is aimed to support it with carbon fiber reinforced polyamide material. The commercial name of the 35% carbon fiber-based polyamide material is Nylon12-CF. For this study, tensile bars were produced according to ASTM D638 standards. The thickness of the tensile bar was determined as 14 mm and the thickness of the support material was determined as 4-6-8mm. Including the main raw materials, three of the specified tensile bars were produced and tensile tests were performed. When the results of these tensile tests are compared, it is observed that the stiffness of the sample increases with linear percentages as the thickness of the inner filling material increases. In addition, the behavior of the tensile specimens under 100N load was examined with computer aided analysis programs. According to the results of these 2 studies, it was observed that the maximum stresses increased regionally while increasing the rigidity of Ultem 9085 material with the support material.

Oral Presentation

EFFECT of DESIGN and MANUFACTURING CRITERIA on TENSILE BEHAVIOUR of Ti6Al4V LATTICE STRUCTURES PRODUCED by LASER POWDER BED FUSION

Doruk Gürkan[a], Binnur Sagbas[a*], Kadir Kiran[b,c]

[a]Yildiz Technical University, Faculty of Mechanical Engineering, Mechanical Engineering Department, TURKIYE
[b]Suleyman Demirel University, School of Civil Aviation, Department of Aircraft Maintenance and Repair, Isparta, TURKIYE
[c]Suleyman Demirel University, Innovative Technologies Application and Research Center, Design and Manufacturing Laboratory, Isparta, TURKIYE

ABSTRACT

Building up complex geometries due to the freedom of additive manufacturing gives opportunity to various study areas. Design and implementation of lattice structures have become easier with the widespread use of AM technologies. In this way, lattice structures can be produced based on process and lattice parameters which ensure distinctive biomedical properties. Especially titanium alloys are widely used in biomedical areas. Lightweight, porous, durable and suitable biomedical properties of bone implants can be produced by laser powder bed fusion (LPBF) which is one of the remarkable AM technologies. Therefore, lattice topologies also affect these properties and ensure to alter biomedical features. There are many studies about lattice structures but their design and implementation aspects have not been completely concluded. The design of tensile specimens may affect the test results due to unique lattice topology. In this aspect, three different strut-based lattice topologies (octahedron, dodecahedron and star) were selected and their mechanical properties were studied as bone implant material by tensile test. Tensile test specimens were produced as Ti6Al4V in accordance with ASTM-E8/E8M-16a standard. Two separate designs for lattice structure were studied and the results were reported.

Keywords: Additive Manufacturing, Lattice Structures, Laser Powder Bed Fusion, Ti6Al4V, Tensile Test, Orthopedic Bone Implants.

Oral Presentation

DESIGN AND PERFORMANCE ANALYSIS OF DIFFERENT FLAME HIDDEN STRUCTURES

Halil Özaslan[1], Mustafa Bozdemir[2]

[1]Sinerji Silah Ve Muhimmat A.Ş,, Kırıkkale
[2]Kırıkkale Üniversitesi, KMYO, Makine ve Metal Teknolojileri Bölümü, Kırıkkale

ABSTRACT

Ateşli silah teknolojileri sevk barutunun yanması sonrası ortaya çıkan enerjisiyle çalışılırlar. Bu sırada silah namlu ucundan yoğun alev çıkışı ve yüksek basınç boşalması meydana gelir. Oluşan alev ve basıncın ateşli silah sistemi üzerinde olumsuz etkileri bulunmaktadır. Ateşli silahların gece kullanımlarında yüksek alev görünümlerinin ciddi zararları vardır. Oluşan alevler, kullanıcın gözlerini kör edebilir ve düşman kuvvetler tarafından kullanıcının konumunun açık edilmesine neden olurlar. Başlıca bu ve diğer nedenlerden dolayı ateşli silahların namlu ucuna takılan cihazlar geliştirilmiştir. Namlu ucu cihazlarından en yaygın olarak kullanılanları ise namlu frenleri, susturucular ve alev gizleyenlerdir.

Yapılan çalışma da farklı fiziksel özelliklerde alev gizleyen modelleri geliştirilmiştir. Her biri farklı fiziksel yapıda olan bu alev gizleyenler, akış analiz programıyla karşılaştırılmalı incelenmiştir. Bu alev gizleyen modellerinin 3d yazıcıda imalatları da yapılmıştır. Tasarımları SolidWorks ile yapıldıktan sonra SolidFlow ile iç hava akış analizleri yapılmıştır. Bu sayede en iyi alev gizleyen modeli belirlenmiş olacaktır.

Keywords: *Ateşli silah, alev gizleyen, 3D yazıcı*

Oral Presentation

INVESTIGATION of MICROSTRUCTURE AND POROSITY PROPERTIES of AlSi10Mg ALLOYS PRODUCED VIA LASER POWDER BED FUSION

Mert Coskun[a,b*], Binnur Sagbas[b]

[a]Fatih Sultan Mehmet Vakif University, Aluminium Test Training Research Center, Türkiye
[b] Yildiz Technical University, Faculty of Mechanical Engineering, Mechanical Engineering Department, Istanbul, Türkiye

ABSTRACT

Usage of the additive manufacturing technologies is continuously increasing due to the several advantages of the methods. However, more extensive and specialized parts are required to be produced more rapidly. For this aim, developments such as increasing the platform dimensions, increasing the number of lasers, and trying new alloys can be realized. On the contrary, unsuitable situations like increase of the laser numbers and the production of some parts by combining lasers may arise in the production process as the systems become more complex. At different laser intersections; laser junctions and traces are essential factors for the application areas of the produced parts. In this study, it is aimed to examine the physical and microstructural properties of the samples produced in single and multiple lasers with the laser powder bed fusion (L-PBF) method, which is the one of the most well-known additive manufacturing technique. By this way, information about the conditions that the production of the parts could be done efficiently was achieved. Moreover, critical regions of the parts, where failure may occur were also detected. In the current work, the porosity and microstructure properties of the samples manufactured from AlSi10Mg alloy with different laser numbers (1-2-4) by employing the EOS M400-4 machine were investigated. Porosity measurements were conducted with Computerized X-ray microtomography (Micro-CT) method (ZEISS Metrotom). Optical microscope was used for the microstructure analysis. In addition, measurements were also carried out considering the Archimedean method to compare with the Micro-CT results. It is determined from the results that the use of single and multiple lasers for the production of critical parts, which will operate under high and dynamic loads can be a promising solution. If similar results are obtained in all laser numbers, manufacturing with higher number of lasers can be preferred to ensure energy efficiency and low cost.

Keywords: *Laser Powder Bed Fusion, Porosity, Microstructure, Micro-CT, Multiple Laser.*

Oral Presentation

PREDICTION of SURFACE ROUGHNESS of ADDITIVE MANUFACTURED AlSi10Mg PARTS VIA MACHINE LEARNING

Hikmet Güngör[a*], Mert Coskun[a,b] , Binnur Sagbas[a]

[a] Yildiz Technical University, Faculty of Mechanical Engineering, Mechanical Engineering Department, Istanbul, Türkiye
[b]Fatih Sultan Mehmet Vakif University, Aluminium Test Training Research Center, Türkiye

ABSTRACT

As one of the latest emerging manufacturing method due to its unique advantages such as layer-by-layer manufacturing and able to build parts with complex geometries on a wide range of materials, additive manufacturing is focused on by researchers and manufacturers. Furthermore, its ability to process a wide range of metals including AlSi10Mg to build high density and mechanically strong parts to various aerospace, industry and military applications powder bed fusion (PBF) is widely preferred. However, because of operation costs are high due to powder cost, long and energy consuming manufacturing and preparation times combined with a high probability of malfunction makes process risky and non-environmentally friendly. At this point to overcome these limitations implementing data driven approach such as machine learning can be a viable solution if the training of the model is completed correctly. Since the part's surface roughness is correlated with properties such as fatigue strength, corrosion resistance and coatibility of the part, surface roughness is an important parameter. Thus, the implementation of a machine learning model on surface roughness prediction is a feasible application. Thereby training and implementing a machine learning algorithm to predict surface roughness on AlSi10Mg parts manufactured via powder bed fusion method realized in this study. To predict surface roughness on parts with model, various manufacturing parameters such as laser power, scanning speed, hatching distance, layer height and powder size are used as input for machine learning model. Training of machine learning model is done via literature collected parameters and result data. Afterward, trained model results for surface roughness are tested by experimental study. The results obtained by the model and experimental study are compared to each other and accuracy rate of model has been determined.

Keywords: *Machine Learning, Additive Manufacturing, AlSi10Mg, Surface Roughness, Prediction*

Oral Presentation

NUMERICAL MODELLING OF THE WARPING BEHAVIOUR IN FILAMENT-BASED 3D-PRINTED MODELS

R.Ramful

ABSTRACT

The material structure of 3D-models printed via the fused deposition modelling (FDM) technique is mainly affected in the z-direction of the 3D-print as a result of the layer-by-layer approach which tend to exhibit a deformation behavior corresponding to a type of transversely orthotropic material. Moreover, uncontrolled parameters such as printing temperature and printing speed have been reported to adversely affect 3D-print quality leading to undesired effects such as distortion and warpage. The additive manufacturing process is a relatively new field in advanced manufacturing where further research and innovation are required to overcome the limited strength and structural performance observed in presently 3D-printed components. In line with the above, this study proposes the numerical investigation of the warping behavior in PLA (Polylactic acid) - based 3D printed models by considering the finite element method (FEM) software of LS-DYNA. The warping investigation was specifically centered on the cooling cycle prevailing between the layer-by-layer structures. The findings of this study showed that warpage would most likely occur in the thermal process model corresponding to abrupt change in temperature due to a buildup of strain between the bottom most layers of the 3D model and the build plate. The findings of this study, which shed light on the warping behaviour in 3D-models, has direct implications on the final quality of 3Dprinted components

Keywords: *Fused Deposition Modelling (FDM); 3D-Models; Finite Element Methods (FEM); Warping; Thermal Process*

Oral Presentation

GARMENTS INDUSTRY 5.0: TRANSFORMING THROUGH DIGITAL INTEGRATION OF 3D VIRTUAL MEASUREMENT DATA AND CHARACTERISTICS

Semih Donmezer[a*], Pinar Demircioglu[b,c], Ismail Bogrekci[c], Gokcen Bas[a], M. Numan Durakbasa[a]

[a] Vienna University of Technology, Institute of Production Engineering and Photonic Technologies, AUSTRIA
[b] Technical University of Munich, TUM School of Engineering and Design, Institute of Materials Science, GERMANY
[c] Aydin Adnan Menderes University, Faculty of Engineering, Department of Mechanical Engineering, TURKIYE

ABSTRACT

The textile industry is undergoing transformative changes due to digitization, necessitating agile responses from industry stakeholders. Industry 5.0 presents an opportunity for customization in the apparel sector, yet online dress sales and cross-border shopping remain challenging due to size differences, dissatisfaction, and high return rates. Inconsistent body-size tables across brands further confuse online shoppers. To tackle this challenge, a proposed solution is an e-body library, a worldwide digital platform that stores individual body measurements and customer avatars. By leveraging artificial intelligence, this digital-body-size library enables customers to find tailor-fit clothes based on their measurements, promising a personalized shopping experience. This pioneering model aims to enhance customer satisfaction, reduce return rates, and drive the future of the apparel industry.

Keywords: *Textile industry digitization. Industry 5.0. Customization. E-body library. Artificial intelligence (AI) integration.*

Oral Presentation

AN INITIAL EVALUATION OF THE BIOLOGICAL PROPERTIES OF THE SURFACE-MODIFIED 3D-PRINTED POROUS 316L STAINLESS STEEL SAMPLES

Azade Yelten [a,b]* , Alper Haliloglu[b] , Batur Ercan[b]

[a]Istanbul University-Cerrahpasa, Engineering Faculty, Metallurgical and Materials Engineering Department, Avcilar/Istanbul, TURKEY
[b]Middle East Technical University, Engineering Faculty, Metallurgical and Materials Engineering Department, Cankaya/Istanbul, TURKEY

ABSTRACT

Metallic materials are extensively used for orthopedic implants. 316L stainless steel (316L SS) is one of the widely utilized metallic implant materials due to its superior mechanical properties and corrosion resistance. It is an important situation to prepare orthopedic implants that are anatomically compatible with the damaged tissue. An elastic modulus match of the tissue and material should be provided to enable the tissue to remain healthy and share the exposed load with the implant equally. For this aim, porous implant designs can be applied and additive manufacturing systems are ideal to produce such complicated structures. In this study, porous 316L SS parts with octahedron unit cells and 700 µm pore size were prepared with Laser Powder Bed Fusion (LPBF) technique. Subsequently, the surfaces of the samples were modified by applying anodic surface modification. Hence, it was aimed to create nanoroughness on the surface of the material to ensure the cells adhere more effectively, then grow and proliferate. According to the MTT assays, the surface-modified samples did not show any toxic effect on the L929 cells. Cells kept their viability and continued to proliferate at day 5. Cell interaction tests will proceed with osteoblasts depending on this promising result.

Keywords: *Laser Powder Bed Fusion (LPBF), 316L Stainless Steel. Anodic Surface Modification. Biological Properties.*

Acknowledgement: This work was supported by the Scientific and Technological Research Council of Turkey under the project TÜBİTAK 2218 - National Postdoctoral Research Fellowship Programme, Project No. 118C497.

Oral Presentation

PRODUCTION OF ALGINATE/GELATIN SCAFFOLDS LOADED WITH CINNAMALDEHYDE AND MEROPENEM USING A 3D BIOPRINTER FOR CORNEAL INJURIES

Perihan Aydogdu [a,b,*], Emine Beyza Ornek [a,b], Ece Babur [a,b], Sumeyye Cesur , Ali Akpek[b], Oguzhan Gunduz [a,c]

[a]Center for Nanotechnology & Biomaterials Application and Research (NBUAM), Marmara University, Turkey
[b]Department of Biomedical Engineering, Faculty of Electrical & Electronics, Yıldız Technical University, Turkey
[c]Department of Metallurgical and Materials Engineering, Faculty of Technology, Marmara University, Turkey

ABSTRACT
The cornea, a transparent and avascular tissue that directs light to the retina, is easily damaged by injuries, infections, and illnesses. Severe corneal injury can impair vision or possibly cause blindness. However, improving recovery after transplantation and damage remains a substantial problem. With the new generation of drug delivery systems, it is desired to ensure the ocular usability of drugs. In this study, scaffolds were produced using natural polymers of Sodium Alginate (SA) and Gelatin (GEL) with a 3D bioprinter. Cinnamaldehyde (CA) in cinnamon essential oil and Meropenem (MPN), an antibiotic drug, were included in SA/GEL nanofibers to accelerate corneal healing and inhibit bacterial growth. For the porosity and morphological study of the 3D-printed scaffolds, scanning electron microscopy (SEM) was used. The chemical interactions between the medicines and polymers were studied using Fourier transform infrared spectroscopy (FT-IR). The chemical interactions between the medicines and polymers were studied using Fourier transform infrared spectroscopy (FT-IR). Thermal analysis (DSC) was performed to examine the physicochemical properties of the scaffolds, and tensile tests were also performed to evaluate the mechanical strength. In addition, the swelling and degradation behavior of the scaffolds was also investigated. Antimicrobial tests were performed to determine the drug's effectiveness against bacterial activity. The drug release of the drug-loaded scaffolds was evaluated with UV spectrometry, and the biocompatibility of the scaffolds on fibroblast cells was determined by cell culture analysis.
The results of this study show that a combination of Meropenem and Cinnamaldehyde efficiently reduced bacterial growth while additionally supporting corneal regeneration. These improvements have the potential to significantly improve corneal transplantation results and visual recovery in individuals with corneal injuries and infections.

Keywords: *Scaffolds, corneal injuries, 3D bioprinting, natural polymers, meropenem, cinnamaldehyde*

Oral Presentation

DETERMINING MECHANICAL PROPERTIES of Ti6Al4V ADDITIVE MANUFACTURED PARTS at DIFFERENT TEST CONDITIONS

Taylan Ovacık[a], Binnur Sagbas[a*]

[a] Yildiz Technical University, Faculty of Mechanical Engineering, Mechanical Engineering Department, Istanbul, TURKIYE

ABSTRACT

Additive manufacturing (AM) is the process of obtaining three-dimensional geometry layer by layer based on computer aided design (CAD) data. The method, which offers free design in terms of the manufactured geometry, makes it possible to manufacture the product, which is difficult to produce in traditional storage, without the need for any mold, cost or tool. While producing the desired geometry layer by layer with additive manufacturing, many plastic or metal-based materials can be used. Titanium is a frequently used material in aviation and it is important to observe its mechanical properties under different environmental conditions. The aim of this study is to determine the tensile strength values of a titanium alloy produced by additive manufacturing methods under different temperature conditions and to examine the mechanical behavior of the part produced by additive manufacturing. For this purpose, standard tensile test samples were produced by laser powder bed fusion method in x, y and z directions. They were tested at room temperature, 22 ^{o}C and at high temperature, 200 ^{o}C conditions. The results were compared to each other and related literature studies. The mechanical characteristics of Ti6Al4V material, which has been determined to exhibit different responses at different temperature values, for defense and aerospace applications have been evaluated.

Keywords: *Ti6Al4V, mechanical strength, laser powder bed fusion, additive manufacturing*

Oral Presentation

DOUBLE-LAYER DRUG-LOADED TUMOR DRESSING PRODUCTION BY 3D PRINTING AND ELECTROSPINING METHOD

Ayşe Betül Bingöl[1], Canan Yağmur Karakaş[2], Cem Bülent Üstündağ[1]

[1.] Department of Bioengineering, Faculty of Chemical and Metallurgical Engineering, Yıldız Technical University, Istanbul, Turkey
[2.] Department of Food Engineering, Faculty of Chemical and Metallurgical Engineering, Yıldız Technical University, Istanbul, Turkey

ABSTRACT
In this project,an effective method, will be developed for cancer treatment by producing a tumor dressing to be applied specifically to the tumor area.Chemotherapy drugs used in cancer treatment methods spread not only to the tumor area but also to the whole body,which negatively affects the quality of life of the patients.Thus,it is planned to develop a new treatment method that can be applied specifically to the tumor area after surgical intervention and to reduce the toxic effects of anticancer drugs.In addition,a biofunctional tumor dressing was designed by adding antibiotic drugs to prevent bacterial infection that may occur after surgical intervention and pain reliever drug to reduce the physical pain caused by surgical intervention.The first layer of the double-layer hybrid biofunctional tumor dressing will be produced by micro-extrusion-based 3D bioprinting using PVA solution loaded with the anticancer drug DOX.Then,the second layer will be completed by shooting on the first layer by electrospinning using the antibiotic AMOX and PCL solution.The PVA solution prepared with IBU,which is used as a pain reliever at the last stage,will be coated on the surface of the double-layered biofunctional tumor dressing in nanoparticle form using the electrospray method.FTIR analysis for evaluation of chemical structure,SEM analysis for morphological surface characterization,tensile test for mechanical strength,swelling degradation analysis,in vitro release analysis for the characterization of the completed bilayer biofunctional tumor dressing,cell test for the determination of antimicrobial property and MTT test for determination of biocompatibility will be performed.The main expectation is that the biofunctional tumor dressing to be developed will consist of a triple-drug combination,have a unique capacity and be designed to be implantable in the tumor area and small tumors after surgical intervention, resulting in a more effective and efficient therapy result.

Keywords: *3d Printing, Electrospinning, Electro Spraying, Tissue Engineering, Tumor Dressing*

Oral Presentation

3D PRINTING PERSONALIZED TREATMENT METHODS FOR BONE TISSUE ENGİNEERİNG APPLICATIONS

Büşra OKTAY[1], Aysel OKTAY[1,2], Ayşe Betül BİNGÖL[1], Cem Bülent ÜSTÜNDAĞ[1]

[1]Yıldız Technical University, Faculty of Chemical and Metallurgical Engineering, Department of Bioengineering
[2]Turkish-German University, Faculty of Science, Molecular Biotechnology

ABSTRACT
Bone injuries and deformities are one of the major health problems worldwide. To overcome this problem, bone tissue engineering focuses on producing synthetic bones that can be used to treat patients with bone injuries or deformities. Personalized 3D printing is used to produce customized bone prostheses based on the size and shape of the patient's bone damage. Printed in accordance with software-generated algorithms, 3D printing enables the creation of patient-specific bone implants that precisely fit the individual's specific anatomy. This method, which allows 3D-printed bone implants to be tailored to the specific needs of the patient, aims to improve treatment outcomes and reduce the risk of complications associated with incompatible standard implants. Biological materials such as biocompatible polymers and bioactive ceramics can be used in the 3D printing process to ensure that the prosthesis is similar to the patient's existing bone structure and to mimic the biological and mechanical properties of the tissue. In addition, natural bone biopolymers, bioceramics, biological materials and cells are used together. The inclusion of stem cells and growth factors for the production of biofunctional implants can stimulate bone regeneration and accelerate the healing process. Bone tissue engineering, which combines advanced 3D printing technologies with personalized treatment methods, is an interesting application in the field of regenerative medicine. This innovative approach has significant potential in the treatment of bone injuries and deformities by providing tailored solutions that support better patient outcomes and overall quality of life. This review summarizes the analysis, biocompatibility, mechanical properties, and potential of promoting osteogenesis of bioinks and biomaterials for 3D printing in bone tissue engineering. So, this review encourages interdisciplinary collaboration and supports innovation in regenerative medicine.

Keywords: *Bone tissue, 3D printing, personalized treatment, tissue engineering*

Oral Presentation

3D PRINTING BIOFUNCTIONAL WOUND DRESSING DESIGN FOR DIABETIC FOOT ULCER

Anas Qasim [3], Aya Baya[3], Ertuğrul Yıldız[2], Pınar Gençaslan[1],Sude Tuğlu[1] ,Zahide Karadağ[1] ,Cem Bülent Üstündağ[1]

[1] Department of Bioengineering, Faculty of Chemical and Metallurgical Engineering, Yıldız Technical University, Istanbul, Turkey
[2] Department of Biomedical Engineering, Faculty of Electric and Electronic, Yıldız Technical University, Istanbul, Turkey
[3]Department of Biomedical Engineering, Faculty of Natural Siences And Engineering, Medipol University, Istanbul, Turkey

ABSTRACT
Diabetes is an increasing health problem around the world and is associated with complications such as diabetic foot ulcers in patients exposed to long-term high blood sugar levels.Diabetic foot ulcers are among the conditions in which foot wounds occur due to long-term tissue damage and the healing process becomes difficult.Instead of conventional methods, advances in biotechnology offer new hope in the treatment of this type of chronic wounds.
This study aims to design an wound dress for diabetic foot ulcers by using advanced technologies to get an effective and rapid healing. A three-layer structural dress with different methods, and each layer will perform a specific function to maximize wound healing.
First layer,a mixture of polylactic acid(PLA)and hydroxyapatite(HA) performed by 3D printing.It will provide extra protection by covering the wound,while facilitating and accelerating the healing of the scar tissue.In the second layer, nanofibers will be formed by combining polyvinyl alcohol (PVA) and (GO) nanoparticles by electrospinning method.That combination will promote rapid tissue regeneration and reduce the risk of infection thanks to its antibacterial properties.In the third layer, the mixture of polyvinyl alcohol (PVA) and the Methotrexate will be formed by electrospraying. This layer aslo provide an antibiotic effect together with the drug for rapid healing.
Characteristic analyzes of the dressing are;Scanning electron microscopy(SEM)tests for microstructures,Fourier transform infrared spectroscopy(FTIR)for chemical analysis and mechanical propertiessuch as tensile, swelling and modulus of elasticity will be evaluated with mechanical test equipment.Performance characteristics such as antimicrobial and drug release capacity will be determined and will provide information for the effectiveness and potential use of the developed wound dressing.

Keywords: *Tissue engineering, Diabetic Foot ulcer Wound dressing, Electrospinning,3D printer, Electrospraying.*

Oral Presentation

DESIGN AND PRODUCTION OF A MICRONEEDLE PATCH-BASED DRUG DELIVERY SYSTEM FOR MELANOMA SKIN CANCER TREATMENT

Shhd saraj[1], Louna karzoun[1], Simaf süleyman[1] , Ahmad altabel[1] , Tuba bedir[1], Ilkay Şenel[1], Ayşe betül bingöl[1], Büşra oktay[1], Cem Bülent Üstündağ[1]

Department of Bioengineering, Faculty of Chemical and Metallurgical Engineering, Yıldız Technical University, Istanbul, Turkey

ABSTRACT

In this study, a literature review was conducted to explore existing treatments for melanoma cancer, which is considered the most dangerous type of skin cancer. Despite its lower incidence compared to other skin cancers, the current therapeutic approaches have notable limitations. To address these shortcomings, a novel treatment method is proposed, involving a nanofiber-coated microneedle containing chemotherapy. With this method, chemotherapy is given directly to tumor cells by preventing the spread of the drug throughout the body. In addition, it is expected to reduce the financial burden of treatment while improving the quality of life of patients by shortening the duration of treatment. In the proposed project, the microneedle designed for melanoma will be a solid microneedle patch to be fabricated with a 3D bioprinter and coated with electrospun nanofiber.The type of polymer chosen is polyvinyl alcohol, known as PVA. The reason for choosing this polymer is that it is easy to print because it is a synthetic polymer. Also, GelMa will be combined with PVA to increase the porous strut surface of the PVA solution. This will reduce the pressure needed during the printing process. The doxorubicin (DOX) anticancer drug will be loaded into the highly biodegradable PVA/GelMa solution so that the drug will target tumor cells. In the proposed project, the electro-spinning device will be used to produce nanofibers containing PVA, silver nanoparticles, and graphene oxide that cover the microneedle patch. The method used to produce silver nanoparticles is the green synthesis method, which is non-toxic and environmentally friendly. In addition, the nanofiber also has antibacterial properties that lead to reduced inflammation of the skin with long-term use to prevent skin damage. As a result of this project, it is aimed to provide DOX to tumor cells by performing a microneedle patch design as a drug delivery system with DOX chemotherapy, which will reduce the spread of the drug in the body and prevent skin inflammation.The designs were created in a computer environment using a CAD program. This concept, which is efficient in theory and design, is expected to be successful both economically and practically.

Keywords: *Melanoma skin cancer, Micro Needle patch, Electrospinning method, 3D bioprinter, Doxorubicin (DOX).*

Oral Presentation

EFFICIENCY EVALUATION OF SMART MANUFACTURING SYSTEMS FOR MONITORING PRODUCTION EFFICIENCY AND QUALITY

Erman ZURNACI[1], Sabri UZUNER[2], Engin NAS[3]

[1]Kastamonu University, Faculty of Engineering and Architecture, Department of Mechanical Engineering
[2]Düzce University, Faculty of Engineering, Department of Mechatronic Engineering
[3]Düzce University, Dr. Engin PAK Cumayeri Vocational School, Department of Machine and Metal Technologies

ABSTRACT
The digitalization of every stage of the production chain, the increase of machine-human interaction, and the development of smart manufacturing technologies have brought different approaches to the industry. The development and spread of Industry 4.0 technologies have caused new production models to change in the manufacturing industry.

Quality and efficiency of the product manufactured: It depends on quality, speed, efficient use of resources, and reducing production errors. It is crucial to ensure the efficiency of manufacturing parameters such as cutting tool cost, energy consumption, time, and workforce, which constitute high costs, especially in machining methods. The need for optimum selection of all these parameters and ensure efficiency in production requires the application of smart manufacturing technologies to traditional manufacturing systems.

Smart manufacturing systems help collect and process data using Industry 4.0 technologies in monitoring the manufacturing process. Thus, every manufacturing stage can be followed, and the collected data can be reported. The data obtained can be used to improve quality and efficiency.

In this study, the effects of smart manufacturing systems on the manufacturing industry were examined. The methods used in real-time monitoring of the manufacturing process and the development of predictive maintenance applications with Industry 4.0 technologies were evaluated. The performance of smart manufacturing systems adapted to CNC machines in visualizing and reporting manufacturing efficiency was examined. It has been assessed that production time, maintenance costs, and energy consumption can be reduced, and cutting tool life can be increased with smart manufacturing systems used on traditional manufacturing machines.

Keywords: Digital industry, smart manufacturing systems, industry 4.0, manufacturing efficiency, energy consumption.

Oral Presentation

EFFECTS OF HEAT TREATMENT ON WEAR AND MICROSTRUCTURE PROPERTIES OF ALSI10MG ALLOYS PRODUCED BY SELECTIVE LASER SINTERING AND CASTING METHOD

Ahu Çelebi[a*], Semih Çetinkaya[a], Mustafa Mertcan İmanç[a]

[a]Manisa Celal Bayar University, Engineering Faculty, Metallurgy and Materials Engineering Department, TURKEY

ABSTRACT

In this study, the microstructural properties, hardness and abrasive wear properties of AlSi10Mg alloys produced by both different production methods after heat treatment were investigated. The samples were produced by Selective Laser Melting (Horizontal and Vertical) and casting method. The samples with different mechanical properties were heat treated at 300°C for 5 hours. Hardness and abrasive wear tests were performed on AlSi10Mg alloys produced by both different production processes with and without heat treatment, and their detailed microstructures were analyzed by both optical microscope and SEM. In the abrasive wear test, the samples were tested under 10 N load, 20 cm/sec sliding speed, 10 m sliding distance. Phase analyzes were performed using PANalytical EMPYREAN X-ray diffraction device (XRD) at a diffraction angle of 5°-85° and their effects on wear performance were investigated. The best wear results were obtained for the samples produced by the Selective Laser Melting method.

Keywords: *Metal additive manufacturing; selective laser melting; AlSi10Mg alloys; mechanical properties of aluminum alloys.*

Oral Presentation

JOINING PARTS MANUFACTURED BY ADDITIVE MANUFACTURING METHOD WITH WELDING METHOD USING FILLING MATERIAL

Cansu Sibel Eraslan[a*], Gökhan Küçüktürk[b]

[a]Gazi University, Graduate School of Natural and Applied Sciences, Mechanical Engineering, TURKEY
[b]Gazi University, Faculty of Engineering, Mechanical Engineering, TURKEY

ABSTRACT

Today, the interest in additive manufacturing methods is increasing and they are used in many areas. Sectors where the use of additive manufacturing gains importance are Aviation, Automotive, Medical, etc. can be listed as One of the most important reasons why additive manufacturing methods gain importance in these sectors is that, unlike conventional manufacturing methods, they significantly reduce the factors limiting the design. It also allows direct generation of 3D design data. In addition to all these advantages, the disadvantage of additive manufacturing is the size limitation of the machines that perform the production. For this reason, it is not possible to produce large parts in one go. In order to prevent the disadvantage of size limitation, the studies of joining the parts produced by the additive manufacturing method with the welding method have gained importance recently. Within the scope of this study, two parts produced by the additive manufacturing method will be joined by the welding method. During the welding application, the third part will be used as a filling material and the porous structure observed in the welding area will be investigated.

Keywords: *Additive Manufacturing. Welding. Plates.*

Oral Presentation

FINITE ELEMENT ANALYSIS OF RESIDUAL STRESSES IN CONFORMAL HYBRID NON-PLANAR LARGE-SCALE ADDITIVE MANUFACTURING: EVALUATING THERMAL EFFECTS AFTER ABS – STEEL BONDING

Mehmet Aladag*[*1], Omer Eyercioglu[2], Engin Tek[3], Mehmet Ali Akeloglu[2], Izabela Zgłobicka[1] Krzysztof Jan Kurzydłowski[1]

[1] Bialystok University of Technology, Faculty of Mechanical Engineering, Wiejska 45C, 15-351 Bialystok, Poland
[2] Gaziantep University, Engineering Faculty, Mechanical Engineering Department, 27310, Gaziantep, Türkiye
[3] Gedik University, Gedik Vocational School, Mechatronic Program, 34906, Istanbul, Türkiye

ABSTRACT

Conformal 3D printing is emerging as a promising method for fabricating multi-material elements and geometry-fitting applications or surface coating such as polymer coating on dissimilar material surfaces. However, bonding limitations and subsequent delamination can arise when conformal printing is performed on dissimilar materials. To address this issue, surface modification techniques are employed to enhance the bonding capacity between these dissimilar materials. In the case bonding is successfully made, some amount of residual stresses will be encountered in the interface due to the cooling and thermal behavior of the polymer (thermal expansion and contraction). In this study, we aim to estimate the residual stresses that occur as a result of conformal 3D printing using a finite element method. Specifically, a 2D finite element model will be developed to simulate the deposition of molten ABS polymer onto a non-planar steel surface. Two different bed temperatures 25°C, and 80°C were set as a reference to compare. Assuming successful bonding, the residual stresses will be investigated after the ABS polymer cools.

Keywords: *Non-planar 3D printing, Finite element modeling, residual stress, dissimilar materials, large-scale additive manufacturing.*

Oral Presentation

MOLTEN METAL DEPOSITION: THE SINGLE-STEP DIRECT ALUMINIUM ADDITIVE MANUFACTURING TECHNOLOGY

Meh Jonas Galle [a*], Chola Elangeswaran Jan De Pauw [a], Kim Vanmeensel [b], Brecht Van Hooreweder [c]

[a] ValCUN, Belgium
[b] KU Leuven, Department of Materials Engineering, BELGIUM
[c] KU Leuven, Department of Mechanical Engineering, BELGIUM

ABSTRACT

Metal additive manufacturing continues to evolve into a unique manufacturing solution, capable of producing complex and intricate-shaped designs. However, the technology is still lacking behind for large scale industrial adoption. Some barriers hindering this adoption are total production times, handling methods, and integration into existing production chain. These hindrances are especially amplified for aluminium alloys, resulting in a slower than expected progress in aluminium additive manufacturing, despite the large scale aluminium utilisation in diverse applications. This paper introduces a new technology called Molten Metal Deposition (MMD) to address these challenges and to help enabling mainstream aluminium additive manufacturing. Use of wire feedstock, absence of lasers, reduced/non-existent support structures, negligible thermal stresses and high productivity are some unique features of MMD, allowing automation and processing of high strength Al alloys (6xxx and 7xxx). The working principle of Molten Metal Deposition, the microstructure and mechanical properties observed in the built parts are described in this paper.

Keywords: *Metal additive manufacturing, aluminium additive manufacturing, microstructure, mechanical properties, solidification.*

Oral Presentation

THE USE OF ORTHOSES MADE WITH 3D PRINTER IN UPPER EXTREMITY REHABILITATION: A SYSTEMATIC REVIEW

Sümeyye SARIŞAHİN[a]*, Zeynep ÇORAKÇI YAZICIOĞLU[a]

[a] Bezmialem Vakif University, Health Science Faculty, Occupational Therapy Department, TURKEY

ABSTRACT

The development of modern technology understanding in the world provides improvement in many health services. In parallel with modern technology, 3D (3 Dimensional) printing technologies, which have a wide range of uses, have recently become a resource used in the "rehabilitation" process, which is considered within the scope of health services. In a specialized field such as upper extremity rehabilitation, 3D printers can produce personalized, aesthetically pleasing, lightweight and environmentally friendly orthoses in a short period of time. Thanks to 3D scanning systems, the orthosis production process and the final product can be predicted, and upper extremity orthosis models can be saved. Model registration can provide advantages in accessibility, repetitive and multiple productions. On the other hand, from the point of view of service providers and recipients, limited evidence-based practices and high costs of 3D printers and equipment in developing countries may negatively affect the application to the source. The use of 3D printed orthoses in upper extremity rehabilitation is expected to become more widespread soon with the improvement of the interfaces of the programs used in the steps of orthosis production with 3D printing, the design of models in which 3D printed orthoses are integrated into upper extremity rehabilitation, and the development of technology. There is a need for more evidence-based studies in which the parameters related to the use of 3D printing technologies in upper extremity orthosis production are examined with large case groups.

Keywords: *Orthoses, 3D printer, upper extremity, rehabilitation.*

Oral Presentation

TAGUCHI ANALYSIS OF FDM 3D PRINTED PLA PARTS BASED ON THEIR TENSILE STRENGTH

Abdurrahim Temiz[a*], Fatih Huzeyfe Öztürk[a], Murat Aydın[a]

[a]Karabuk University, Technology Faculty, Industrial Design Engineering Department, TÜRKİYE

ABSTRACT

There is a strong relationship between the process parameters used in Fused Deposition Modeling (FDM) 3D printing and the characteristics of the printed part, making careful parameter selection essential. This paper therefore presents the results of an experimental and statistical investigation into the relationship between the tensile strength of Polylactic acid (PLA) filament and a number of printing parameters, including raster orientation, extruder temperature, and infill density. The experiment was repeated using three distinct PLAs, and it was investigated whether the effect ratios of the process parameters changed depending on the material used. Nine experiments with L9 Taguchi's Orthogonal array model fractional factorial design were set for each PLA type, and PLA specimens were printed on an FDM 3D printer and tested for tensile strength. Analysis of Variance (ANOVA) is then used to show which parameters significantly affected tensile strength after the optimal combination had been chosen. In addition, a linear regression model has been created to predict the printed part's tensile strength. On-edge, 220°C, 100 percent, and 0 degrees, respectively, are the optimal values for temperature, infill ratio, and raster orientation. The tensile strength of PLA, PLA star, and PLA premium filaments is most affected by the infill ratio (94.87%, 87.93%, and 88.27%, respectively). The infill ratio is the only variable among all PLA types with a significance level lower than 0.05. With a p-value of less than 0.05, raster angle is also a contributor to the PLA premium.

Keywords: *3D printing, additive manufacturing, Taguchi method, process parameters*

Oral Presentation

SURFACE QUALITY ENHANCING OF INTERNAL CHANNELS OF ADDITIVELY MANUFACTURED PARTS BY USING ABRASIVE FLOW MACHINING (AFM)

Omer Eyercioglu*[a], Mehmet Ali Akeloglu[a], Mustafa Emre Karadag[a], Mehmet Aladag[b]

[a] Gaziantep University, Engineering Faculty, Mechanical Engineering Department, Gaziantep, TURKEY.
[b] Bialystok University of Technology, Mechanical Engineering Faculty, Bialystok, POLAND.

ABSTRACT

Additive manufacturing has become an important production method nowadays and thanks to the developments in this field, it makes it possible to manufacture complex parts with new practical properties. For example, the design of the molds made it possible to produce complex cooling channels that follow the surface shape known as conformal cooling. The conformal cooling channel is simply a map projection of the parts surface and it was created to ensure uniform and quick cooling while maintaining a constant distance between the cooling channel and the component surface. This technology makes it possible to increase the cooling rate capacity and also provides uniform cooling across the surface. Although additive manufacturing methods make it possible to produce parts with complex conformal internal cooling channels, parts produced with additive manufacturing usually have surfaces with a high degree of roughness. Because of the negative effects on the part's fatigue life and stress concentration caused by this rough surface, it limits its usage in industrial applications. To enhance their surface quality, these parts require post-processing. However, this post-processing enhancement cannot be performed with conventional methods due to the complex geometry of the conformal cooling channels. That is why, the abrasive flow machining (AFM) process which, is an option with better results in the surface finishing of internal channels, is used to improve the conformal cooling channel surfaces. The purpose of this study is to surface enhance of fused deposition modeling (FDM) three-dimensional (3D) printed with poly lactic acid (PLA) parts conformal mapping channels using abrasive flow machining (AFM).

Keywords: *Additive Manufacturing (AM), Fused Deposition Modelling (FDM), Conformal Cooling, Abrasive Flow Machining (AFM).*

Oral Presentation

ROAD ACCIDENT FORECASTING USING MACHINE LEARNING ALGORITHMS

Hanane Zermane[1], Abderrahim Zermane[2]

[1]Batna 2 University, Faculty of Technology, Industrial Engineering Department, Laboratory of Automation and Manufacturing, Algeria
[2]University of Putra, Faculty of Engineering, Department of Chemical and Environmental Engineering, Safety Engineering Interest Group, Malaysia

ABSTRACT

Road accidents pose a significant threat to public safety and traffic management. This research paper presents a comprehensive study on the development and application of machine learning algorithms for the predictive modeling of road accidents. With the increasing availability of diverse data sources, including accident reports, weather data, and traffic information, machine learning techniques offer a promising approach to predict and prevent accidents. A range of machine learning algorithms is applied and evaluated. Model training and evaluation processes are detailed, showcasing performance metrics such as accuracy, precision, recall, and F1-score. These results provide valuable insights into the effectiveness of different algorithms in predicting road accidents. In the discussion section, we interpret the findings in the broader context of road safety and accident prevention. We analyze the impact of specific features on model performance and discuss the potential implications of our research for traffic management and policy-making. In conclusion, this research underscores the potential of machine learning algorithms in road accident prediction and prevention. The models developed in this study offer a promising avenue for enhancing road safety, and the insights gained contribute to the ongoing efforts to reduce accidents and their associated consequences.

Keywords: *Accident Prevention. Machine Learning. Traffic Safety. Road Safety. Accident Forecasting. Risk Assessment. 3D Printing.*

Oral Presentation

THE EFFECT OF MILLING SPEED ON THE PROPERTIES OF CO-CR-MO-W PARTICLES RECYCLED FROM SLM SUPPORT SCRAPS

Hüseyin Can AKSA[a, b, c], Temel VAROL[a, b*], Serhatcan Berk AKÇAY [b]

[a]Karadeniz Technical University, Medical Device Design and Production Application and Research Center,
TÜRKİYE
[b]Karadeniz Technical University, Faculty of Engineering, Department of Metallurgy and Material Engineering, TÜRKİYE
[c]Karadeniz Technical University, Trabzon Vocational School, Department of Electronics and Automation, Biomedical Device Technology, TÜRKİYE

ABSTRACT

Selective Laser Melting (SLM) method, which is one of the additive manufacturing methods that enables the production of complex shaped parts without the need for secondary processes, both enables the production of materials that are difficult to produce with traditional methods and promises a future for mass production as a production method suitable for rapid prototyping. Typically preferred because it produces less scrap, SLM is virtually waste-free, with the exception of support materials and heat-affected powders, which are used only for production stability. However, the reusability of support materials, which are waste after production, is crucial for a sustainable world where responsible production and consumption are important. For this reason, this study focuses on the effects of grinding speed on the recycling of Co-Cr-Mo-W alloy materials, which are used as support materials in the SLM method and become scrap, as qualified metallic powders by ball milling method. In this study, SLM waste Co-Cr-Mo-W alloy support materials were subjected to ball milling using 10 hours grinding time and different grinding speeds. Grinding speeds were determined as 200, 300 and 400 rpm and the effects of grinding speed on particles were investigated.

Keywords: *Additive Manufacturing, Ball Milling, Selective Laser Melting, Recycle, Waste to product*

Oral Presentation

ADOPTION OF METAL ADDITIVE MANUFACTURING IN NNPC LIMITED: CURRENT STATE AND CHALLENGES

Al-Amin Barambu Umar[a*], Muniru M. Mai[a], Devon Hagedorn-Hansen[b]

[a]Nigerian National Petroleum Company Limited, Research, Technology and Innovation Nexus, NIGERIA
[b]HH Industries, Research & Development Department, SOUTH AFRICA

ABSTRACT

Metal additive manufacturing has emerged as a promising technology with vast potential in the oil and gas industry. The Nigerian National Petroleum Company (NNPC) Limited recognizes the significance of this technology and has initiated efforts to adopt metal additive manufacturing within its operations. This paper aims to provide an overview of the current state of metal additive manufacturing in the NNPC and highlight the challenges faced during its adoption process. The study goes on further to suggest strategies and future directions to ensure successful company-wide and industry-wide adoption and acceptance.

Keywords: *Direct Metal Laser Melting (DMLM), Metal Additive Manufacturing (MAM), Oil and Gas, Spare parts manufacturing.*

Oral Presentation

THE IMPACT OF SUSTAINABLE INNOVATION ON BUSINESS PERFORMANCE

Banu (SARIKAYA) ÖZKESER

Koluman Otomotiv Endüstri A.S., R&D Center, TURKEY

ABSTRACT

It is mandatory that mid-term or long-term planning in businesses must have strategic and organizational skills in sustainable innovation. After analyzing market trends, the ability to predict, accessing and evaluating technological information, it is possible to talk about a strategic capability. The most important factor of an innovation manager is to be aware of how to activate the creativity potential. Unfortunately, some of modern innovations may consist of completely closed and one-sided communication whereas the center of the business is based on share of knowledge. In addition to this, values and beliefs of enterprises from the past to the present form the structure of companies. This study aims to analyze the arguments affecting the enterprises for sustainable innovation and to define the relationship between the business performance and sustainability in innovation by using SPSS.
The case study consists of the survey done for 120 R&D Centers in Turkey. For this purpose, the survey, conducted on sustainable innovation and business performance, shows that there is a linear correlation between these factors. Moreover, the results can also be taken into consideration as inputs in the technology road map.

Keywords: *Sustainable innovation, business performance, creativeness, R&D Center*

THERMAL TREATMENT AND CHARACTERIZATION OF TI-6AL-4V ALLOY PRODUCED BY SLM (SELECTIVE LASER MELTING) METHOD

Esra Zerina APPAVURAVTHER[1], Ahmet TURK[2]

[1] Nikhef/ University of Camerino/ Italy Physics Division- PhD Researcher
[2] Manisa Celal Bayar University- Dean of the Faculty of Engineering- Metallurgy and Materials Engineering Department Professor

ABSTRACT

Additive Manufacturing (AM), also known as 3D printing, has gained significant traction in various industries due to its capability to fabricate intricate structures by layering material based on digital models. This technology enables the production of components that would be impractical or hard to manufacture using conventional methods. It has found particular favor in aerospace, aviation, and biomedical sectors due to its numerous advantages. However, AM-produced parts often exhibit residual stresses that can diminish the material's ductility. In biomedical applications, materials must possess high ductility and toughness to prevent undesirable brittle fractures in implants meant to integrate with bone tissue. Biomedical materials that are overly brittle or lack sufficient ductility fail to meet the desired properties. To enhance the structural and mechanical characteristics of these materials, additional post-processing steps are required following the manufacturing process. This article investigates the impact of heat treatment on samples created using the Powder Bed Process-Selective Laser Melting (SLM) method, utilizing Ti-6Al-4V alloy powder material. Additionally, these samples feature micro and nanostructured TiO2 films formed through anodization. The study assesses various structural properties such as porosity, optical characteristics, and scanning electron microscopy (SEM), as well as mechanical properties including surface roughness and microhardness. The heat treatment results in materials suitable for use in biomedical applications.

Keywords: *Additive Manufacturing (AM), 3D Printers, Powder Bed Process, Selective Laser Melting (SLM), Ti-6Al-4V Alloy, Biomedical Material, Heat Treatment, Nano porous TiO2 film.*

10 AREAS OF 3D PRINTING TECHNOLOGY HAS SIGNIFICANTLY IMPACTED OUR LIVES

Esra Zerina APPAVURAVTHER[a]*, Abdullah ALTIN[b], Kerim ÇETİNKAYA[c]

[a] University of Camerino Italy, Physics Division Materials Science Department, NIKHEF Amsterdam Science Park, PhD Researcher,*
[b]Van Yüzüncü Yıl University, Van, TÜRKİYE,
[c]Faculty of Art and Design, Antalya Belek University, TÜRKİYE,

ABSTRACT

Over the past few years, there have been numerous technological innovations with significant impacts worldwide. One of the areas that has most profoundly affected our lives, in conjunction with the digitalized world, is the invention of 3D printers that create tangible three-dimensional objects in real-time based on digital designs. Today, there are various types of 3D printers available, capable of producing objects from different material types such as polymers (plastics), metals, ceramics, composites, and hybrids. This technology, at the center of our lives, has brought about many innovations, facilitating both scientific and artistic endeavors. This study, like the aforementioned technology that directly influences our lives and continues to do so, delves into various fields with detailed examples. In general, ten areas including art, food, fashion, everyday tools and utensils, weapons industry, transportation, construction, 3D-printed organs and prosthetics in healthcare, are examined. This work aims to highlight how this emerging manufacturing technology, with the addition of different fields in the future, is poised to further simplify daily life.

Keywords: *3Dimensional (3D) Printing, Additive Manufacturing, Digital Industry*.

Oral Presentation

INVESTIGATION OF A LIQUID-COOLED COLD PLATE PRODUCED WITH ADDITIVE MANUFACTURING TECHNOLOGIES

Murat Parlak[a*], Oğuz Doğan[a], Ergun Örs[a]

[a]ASELSAN INC, REHIS Division, TÜRKİYE

ABSTRACT

In this study, a compact liquid-cooled cold plate is investigated with different manufacturing technologies. A cold plate is the main part of a phased array radar system due to its cooling mission and providing a carrier for all the electronics to achieve both the mechanical and electronics requirements of a system. Because of the many attractions of Additive Manufacturing (AM) technologies, which are very popular nowadays, it is selected to produce a complex cold plate for both cooling and hydrodynamic purposes. Before going on to the manufacturing stage, some numerical analyses are performed to find the optimal design. Therefore, fin design is done to provide efficient cooling as well as necessary pressure drop to be compatible with the rest of the system. After the production stage, the cold plate which is produced by AM technology and FSW (Friction Stir Welding) has been tested with a liquid (EGW-Ethylene Glycol Water mixture) cycling system to measure the pressure drop along the cold plate. The main results are also shared in this study. The main conclusion of the present study is that it seems that there is much to do to have smaller surface roughness at the internal surface to predict the pressure drop as the cold plate or similar parts are produced with AM technology.

Keywords: *Liquid cold plate, electronic cooling, friction stir welding, surface roughness effect, additive manufacturing*

Oral Presentation

HARDNESS VARIATION AND MICROSTRUCTURAL CHARACTERIZATION OF BIMETALLIC 316L STAINLESS STEEL/INCONEL 625 WAAM COMPONENT

Hülya Kumek[a], Uğur Gürol[a,b*], Savaş Dilibal[c], Mustafa Koçak[c]

[a]İstanbul Gedik University, Faculty of Engineering, Metallurgical and Materials Engineering, TÜRKİYE
[b]İstanbul Gedik Üniversity, Welding Technology Application and Research Center, TÜRKİYE
[c]İstanbul Gedik Üniversity, Faculty of Engineering, Mechatronics Engineering, TÜRKİYE

ABSTRACT

The stainless steel and nickel-based bimetallic components are mainly used in industrial applications requiring high-temperature strength and corrosion-resistant materials such as the nuclear industry, chemical plants, and oil and gas industries. However, the structural performance of bimetallic components manufactured using wire arc additive manufacturing (WAAM) is mainly characterized by their interface properties affected by employed wires, deposition paths, and process parameters, etc. This study aimed to investigate hardness variation and microstructural changes of the bimetallic 316L stainless steel/Inconel 625 WAAM component through the building direction. A total of 30 layers with Inconel 625 wire were deposited on top of the stainless wire (SS 316L) to obtain a bimetallic component having 60 layers. The macro and microstructural investigations were performed to analyze microstructural changes. The Vickers hardness test was conducted throughout the interface region to identify the hardness variation of the bimetallic component. The results showed that the stainless-steel side was comprised of ferrite (δ) in the austenitic matrix while the Inconel 625 side consisted of the Ni-FCC matrix solidified in solidified columnar, cellular, and dendritic modes. Both sides were clearly distinguished on the interface due to the great difference in melting temperature of both wires. The Vickers hardness results on both sides showed slight variation due to thermal cycling, however, tended to increase from the stainless-steel side to the Inconel 625 side.

Keywords: *WAAM, Bimetallic components, Nickel-based superalloy, Stainless steel, Interface characterization*

Oral Presentation

INVESTIGATION OF THE EFFECT OF GAS PRESSURE ON GRAIN SIZE IN THE PRODUCTION OF ALSI10MG ALUMINUM ALLOY POWDER BY GAS ATOMISATION METHOD

Mustafa Boz [1], Selim Korkmaz [2], Namık Kılıç [2], Yeşim Güngör [2], Ertuğrul Gök [2]

[1]Gazi Üniversitesi, Teknoloji Fakültesi, İmalat Mühendisliği, 06100, Ankara
[2]TMC POWDER METAL, 06980, Ankara

ABSTRACT

In this study, the effect of gas pressure on the grain size of alsi10mg alloy produced by vacuum induction gas atomization (viga) was examined. Constant temperature, fixed nozzle diameter and 5 different gas pressure (35, 40, 45, 50, 60) were applied in the studies. Atomization processes were carried out with nitrogen gas. Gas pressure was kept constant at 40 bar and gas temperature was kept constant at 25 oc. Grain sizes of the produced metal powders were analyzed in pure water environment with mastersizer 3000 device. As a result of the analysis, it has been observed that the particle size does not change when it is exceeded over 45 bar. In the analysis conducted with a scanning electron microscope (sem), it has been determined that the optimal gas pressure value at which fully spherical metal powders with the lowest average grain size can be produced is 45 bar. Since no noticeable change is observed in the particle size over 45 bar, it is not recommended to work with gas pressure over 45 bar.

Keywords: *AlSi10Mg Alloy Powder, Gas Atomization, Metal Powder, Gas Pressure*

Oral Presentation

DEFECT DETECTION OF INDUSTRIAL PRODUCTS WITH DEEP LEARNING METHODS ON SINGLE BOARD COMPUTER

***Burhan DUMAN*[1]**

[1] *Department of Computer Engineering, Isparta University of Applied Sciences, Isparta, TURKEY*

ABSTRACT

In industry, performing quality control due to potential defects that may occur during the production process of manufactured products is critically important. With advancing technology, the detection of defects in manufactured products can be automatically carried out through various methods. One of these methods relies on computer vision based on deep learning. High-resolution cameras capture images of the product from different angles, and visual defects can be largely detected using deep learning and image processing methods. Deep learning algorithms enable object recognition, object classification, image segmentation, and natural language processing. Defect detection is mainly achieved through object recognition algorithms, which are categorized into single-stage (SSD, YOLO) and two-stage (R-CNN, Faster R-CNN) detection algorithms. The most popular single-stage object recognition algorithms and prevalent two-stage detectors are R-CNN and Faster R-CNN.

This study compiles existing research in the literature to evaluate the success of deep learning models in industrial applications concerning limited devices. By examining examples where deep learning algorithms are used, the successes and limitations of these techniques for defect detection in different industrial sectors have been addressed. Automatic defect detection can be achieved with limited resources, known as single-board computers, ensuring lower budgets and mobility. Especially when resources are limited and the focus is on real-time defect detection, models such as YOLO (YOLOv3, YOLOv4, YOLOv5) stand out in terms of speed, while SSD models stand out in terms of accuracy. Two-stage detectors lag in the usage of devices with limited resources due to their complex architectures.

Keywords: Defect detection; Industrial product, Deep learning, Single-board computer

Oral Presentation

INVESTIGATING THE MACHINABILITY OF METAL ADDITIVE MANUFACTURING: A CONCEPTUAL FRAME

Arda Pazarcıkcı[1], Zihni Alp Çevik[2], Koray Özsoy [3]

[1] Department of Mechatronics Engineering, Isparta University of Applied Sciences, Isparta, TURKEY
[2] Department of Electronics and Automatication, Besni Vocational School, Adıyaman University, Adıyaman, TURKEY
[3] Department of Machine and Metal Technologies, Isparta OSB Vocational School, Isparta University of Applied Sciences, Isparta, TURKEY

ABSTRACT

The rise of additive manufacturing technologies, also known as 3D Printing, in different industries by making factories smarter has increased significantly in recent years. Additive manufacturing (AM) is the technology of making solid objects by adding materials layer by layer based on computer-aided design (CAD). Additive manufacturing technology promises to accumulate material for design flexibility in complex-shaped parts and produce with limitless geometric freedom. One of the most critical technologies used for additive manufacturing is machining. Machining processes obvious to also finish additively manufactured components by machining. In the study, a theoretical perspective on using the machining for additive manufacturing is presented. As a result of the detailed literature-based research of the study, some suggestions were made by making use of current situations and the conceptual framework we proposed.

.

Keywords: Additive manufacturing, Machining, 3D printing, finishing

Oral Presentation

A COMBINED FINITE ELEMENT-MACHINE LEARNING FRAMEWORK FOR DEVELOPING PRINTABILITY MAPS IN LASER POWDER BED FUSION OF AISI 316L STAINLESS STEEL

Muhammad Arif Mahmood and Marwan Khraisheh*

**Mechanical Engineering, Texas A&M University in Qatar, Doha-Qatar*

ABSTRACT

Additive manufacturing (AM) has gained popularity due to several advantages over traditional manufacturing processes, due to its versatility, ability to manufacture customized and complex products, and rapid repair capabilities. More importantly, AM enhances the resilience of manufacturing systems by offering on-site and on-demand manufacturing of customized components with less dependence on the traditional supply chain model. Among the main challenges facing AM is the limited predictive capabilities of defects during the printing process and the difficulty to optimize the many highly interrelated process parameters to produce defectsfree components. Currently, there is no deterministic criterion to identify and quantify imperfections within the manufactured parts. In this study we propose a methodology that combines experimentally validated finite element models with machine learning to develop printability maps for the laser powder bed fusion (LPBF) of AISI 316L stainless steel. Regions in the process space associated with lack of fusion (LOF), balling (BAL), and keyhole formation (KHF) are considered as a melt pool geometry function, determined using a Finite element simulation model containing temperature-dependent thermophysical properties. Experiments are performed to validate the printability maps obtained using simulations. The printability maps produced by the proposed methodology can be used to identify the processing window for a given material.

Oral Presentation

EFFECT OF ARTIFICIAL AGING PROCEDURES ON FLEXURAL STRENGTH OF DIFFERENT 3D PRINTED RESINS FOR PEDIATRIC DENTAL CROWNS

S. Kutalmış Buyuk[1], Yasemin Nur Korkmaz[2], Huseyin Simsek[3], Feridun Abay[1]

[1]Department of Orthodontics, Faculty of Dentistry Ordu University, Ordu, Türkiye.
[2]Department of Orthodontics, Faculty of Dentistry Bolu Abant Izzet Baysal University, Bolu, Türkiye.
[3]Department of Pediatric Dentistry, Faculty of Dentistry Ordu University, Ordu, Türkiye

ABSTRACT

Aim: The aim of this study was to evaluate the artificial aged and non-aged 3D-printed dental crown resins procedures on the fracture resistance and flexural strength of additively manufactured interim polymers remains unclear.

Methods: Bars (2x2×25 mm) were additively fabricated by using a 3-D printer (NexDent) and different dental crown resins (Saremco Crowntec, Senertek P-Crown V2 and Senertek P-Crown V3) as per the manufacturer's recommendations. Each subgroup was divided into non-aged and aged subgroups (n=10). Thermocycling procedures (5–55 °C, 5000 cycles) was performed under favorable conditions. The flexural strength was measured by using Universal Test machine as MPa.

Results: The highest flexural strength was observed in the Saremco Crowntec (92.06±9.08) non-aged group, while the lowest flexural strength was observed in the P- crown Version 2 (57.08±4.60) aged group.

Conclusions: Artificial aging process decreased flexural strength values in all 3-D Printed dental crown resins groups.

Keywords: Additive manufacturing; 3D Print, Dental Crowns.



ANTALYA BELEK
ÜNİVERSİTESİ
YAYINLARI

Antalya Belek Üniversitesi Yayınları, Antalya
YAYIN NO: 02
e-ISBN: 978-625-99637-0-9