

# EM2024

**2<sup>ND</sup> INTERNATIONAL CONFERENCE  
ON ENGINEERING MANUFACTURE  
PROGRAMME**

9-10 May 2024  
FEUP, Porto Portugal



Thursday 9 May 2024

8:40 **EM 2024 Opening (Room B032)**

9:00\* Effects of microstructure with defects and surface on the fatigue behavior of additively manufactured metallic materials **(EM24\_60)**

M Teschke, S Stammkötter, M Zimpel, F Walther (TU Dortmund University, Germany)

**Session 1A – Additive manufacturing I**

(Chair: MF Vaz and J Lino Alves)

**Session 1B – Composites manufacturing**

(Chair: RJC Carbas and A Akhavan-Safar)

**Room B032**

**Room B035**

9:40 A systematic study of large format additive manufacturing **(EM24\_2)**

H Brito, J Lino Alves (University of Porto, Portugal)

Comparison of thin-shell tool concepts for processing of particle foam beads **(EM24\_65)**

S Handtke (Volkswagen AG, Germany), J Hain, F Fischer, T Ossowski, K Dröder

10:00 Characterization of additively manufactured low alloyed steel using an upsetting test with miniaturized cylindrical specimen **(EM24\_11)**

R März (Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany), P Hetz, D Bartels, M Schmidt, M Merklein

Induction heating simulation for aircraft RTM toolings **(EM24\_21)**

L Brieskorn (Fraunhofer IFAM, Germany), M Rahman

10:20 Tailoring surface properties of LPBF-produced SS316L via laser texturing for targeted applications **(EM24\_46)**

MM Krishna Sai, U Mahata, A Mandal (Indian Institute of Technology (Indian School of Mines) Dhanbad, India)

Bio-inspired helicoidal composite structure featuring graded variable ply pitch under transverse tensile loading **(EM24\_19)**

H Malekinejad (INEGI, Portugal), RCJ Carbas, EAS Marques, LFM da Silva

10:40-11:00 **COFFEE BREAK**

**Session 2A – Forming I**

(Chair: PAF Martins and M Merklein)

**Session 2B – Additive manufacturing II**

(Chair: F Walther and DM Neto)

**Room B032**

**Room B035**

11:00 Numerical and experimental investigation of extrusion processes from coil **(EM24\_8)**

M Leicht (Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany), M Merklein

Development of bio-based designs for the manufacture of vehicle structures **(EM24\_24)**

EAS Marques (University of Porto, Portugal), LPF Garrido, S Jalali, RJC Carbas, LFM da Silva

11:20 Development of a finite element model of the stamping process to analyze the deformation behavior of dimpled beams **(EM24\_16)**

V Pendse, MH Ghazwani (Jazan University, Saudi Arabia), A Alnujaie, R Saminathan, PV Vinh

Biocompatible titanium-niobium scaffolds produced by direct ink writing **(EM24\_34)**

T Vilella (Universitat Politècnica de Catalunya, Spain), G Fargas, D Rodríguez

11:40 Numerical springback prediction for high-strength aluminum alloys based on the sheet metal upsetting test **(EM24\_25)**

P Hetz (Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany), M Merklein

Critical effect of volumetric defects on the fatigue behavior of additively manufactured Ti-6Al-4V **(EM24\_87)**

N Shamsaei, S Shao (Auburn University, USA)

12:00 Improvement of the failure analysis under plane strain condition through an optimized die geometry for the hydraulic bulge test **(EM24\_51)**

A Sawodny (Friedrich-Alexander-Universität, Germany), M Merklein

Characterization of additively manufactured titanium grade 23 structures for application in medical implants **(EM24\_58)**

S Stammkoetter (TU Dortmund University, Germany), M Teschke, I Koek, P Junker, F Walther

12:20	<p>Load path modification by adaption of clinched joint position (<b>EM24_71</b>)</p> <p><u>A Brosius</u> (Technische Universität Dresden, Germany), C Steinfeld</p>	<p>Defect- and microstructure-based characterization of the fatigue behavior of additively manufactured titanium aluminides (<b>EM24_59</b>)</p> <p><u>M Teschke</u> (TU Dortmund University, Germany), J Moritz, A Marquardt, C Leyens, C Körner, F Walther</p>
12:40	<p>On the effect of the third invariant on the strain distribution of isotropic materials subjected to the hole expansion test (<b>EM24_72</b>)</p> <p>MC Oliveira, DM Neto, JL Alves, <u>LF Menezes</u> (University of Coimbra, Portugal)</p>	<p>Enabling solidification processes of complex shapes using common additive manufacturing technologies: Initial experiences (<b>EM24_68</b>)</p> <p>L Robles-Lorite, <u>R Dorado-Vicente</u> (University of Jaén, Spain), E Torres-Jiménez, G. Khanh Pham, G Medina-Sánchez</p>
13:00-14:00	<p><b>LUNCH BREAK</b></p> <p><b>Room B032</b></p>	
14:00*	<p>Function-oriented manufacturing by means of process signatures (<b>EM24_80</b>)</p> <p><u>B Karpuschewski</u> (University of Bremen, Germany), C Heinzel, L Langenhorst, D Meyer, J Sölter</p>	
	<p><b>Session 3A – Roll forming</b></p> <p>(Chair: MC Oliveira and MM Kasaei)</p> <p><b>Room B032</b></p>	<p><b>Session 3B – Machining I</b></p> <p>(Chair: B Karpuschewski and FJG Silva)</p> <p><b>Room B035</b></p>
14:40	<p>Determining initial strip width in roll forming of steel pipes with high thickness-to-diameter ratios (<b>EM24_31</b>)</p> <p>MRK Arjmandi, HM Naeini, MM Kasaei, <u>B Abbaszadeh</u> (Tarbiat Modares University, Iran), MK Firouzjaei, LFM da Silva</p>	<p>A comparative wear evaluation of chromium-coated tools in the drilling of 7075-T6 aluminum alloy, AISI 1045 steel and stainless steel AISI 304 (<b>EM24_26</b>)</p> <p>MC Santos, <u>GF Barbosa</u> (Federal University of São Carlos, Brazil), SB Shiki</p>
15:00	<p>Development of micro roll forming process to fabricate microchannels with high aspect ratio (<b>EM24_33</b>)</p> <p><u>MK Firouzjaei</u> (Tarbiat Modares University, Iran), HM Naeini, MM Kasaei, LFM da Silva</p>	<p>Correlation between vibration signal and roughness during milling of prehardened tool steel with Varacon-coated tools (<b>EM24_98</b>)</p> <p><u>RCM Sales-Contini</u> (Technological College of São José dos Campos, São Paulo, Brazil), A. F. S. Mesquita, MA Arruda, NPV Sebbe, AFV Pedroso, FJG Silva, HM Lopes</p>
15:20	<p>On the prediction of ductile fracture in flexible roll forming (<b>EM24_55</b>)</p> <p>MM Firouzjaei, HM Naeini, <u>MM Kasaei</u> (INEGI, Portugal), B Abbaszadeh, MK Firouzjaei, LFM da Silva</p>	<p>Performances of innovative ceramic tools when turning Inconel 718 (<b>EM24_52</b>)</p> <p><u>N Pozzato</u> (University of Padova, Italy), R Bertolini, S Bruschi</p>
15:40	<p>Research and application on structural design of a novel electromagnetic sheet thickness adaptive roll forming auxiliary device (<b>EM24_66</b>)</p> <p><u>F Han</u> (North China University of Technology, China), B Gu, X Chen</p>	<p>Vibrational and wear behavior analysis of taC-coated tools on Al/CFRP/Al stacks in the milling process (<b>EM24_67</b>)</p> <p><u>RCM Sales-Contini</u> (Technological College of São José dos Campos, São Paulo, Brazil), MA Arruda, NPV Sebbe, AFV Pedroso, VFC Sousa, FJG Silva, HM Lopes, GF Pinto</p>
16:00-16:20	<p><b>COFFEE BREAK</b></p>	
	<p><b>Session 4A – Joining I</b></p> <p>(Chair: LFM da Silva and A Akhavan-Safar)</p> <p><b>Room B032</b></p>	<p><b>Session 4B – Additive manufacturing III</b></p> <p>(Chair: O Barro and R Dorado-Vicente)</p> <p><b>Room B035</b></p>
16:20	<p>Experimental characterisation of a self-healing adhesive through pure and mixed-mode fracture tests (<b>EM24_4</b>)</p> <p><u>AFV Pedroso</u> (Polytechnic of Porto, Portugal), RDSG Campilho, FJG Silva, RJB Rocha, RDFS Costa</p>	<p>Fabrication and characterization of Alvarez freeform lens produced by additive manufacturing (<b>EM24_86</b>)</p> <p>DS Reis, AC Branco, MA Leite, LF Reis, RJ Oliveira, <u>CM Vicente</u> (University of Lisbon, Portugal)</p>
16:40	<p>The performance of CFRP joints with bended adherends (<b>EM24_14</b>)</p> <p><u>RCJ Carbas</u> (INEGI, Portugal), VDC Pires, EAS Marques, LFM da Silva</p>	<p>Evaluation of the roughness of AISI 316 stainless steel produced by laser powder bed fusion (<b>EM24_50</b>)</p> <p>P Nogueira, DC Silva, AP Serro, P Lopes, L Oliveira, JL Alves, L Reis, J Magrinho, C Santos, MJ Carmezim, R Cláudio, AM Deus, MB Silva, <u>MF Vaz</u> (University of Lisbon, Portugal)</p>

17:00	Adhesive bonding technology in automotive battery pack manufacturing and dismantling: A comprehensive review <b>(EM24_18)</b>  VC Rodrigues (INEGI, Portugal), M Kasaei, R Beygi, EAS Marques, RJC Carbas, LFM da Silva	Tailoring elastic modulus of biocompatible beta type Ti alloys by means of laser directed energy deposition <b>(EM24_61)</b>  F Arias-González, A Rodríguez-Contreras, M Punset, JM Manero, O Barro (Universidade de Vigo, Spain), M Fernández-Arias, F Lusquiños, J Gil, J Pou
17:20	Cyclic creep testing of pressure-sensitive adhesives: Design and validation of a tailored apparatus <b>(EM24_6)</b>  BD Simões (INEGI, Portugal), EMD Fernades, EAS Marques, RJC Carbas, S Maul, P Stihler, P Weißgraeber, LFM da Silva	Characterization of the interdiffusion zones at the interfaces of extruded multi-material composites <b>(EM24_77)</b>  H Schneider (Technische Universität Braunschweig, Germany), K Dilger, S Hartwig
17:40	A novel method to evaluate a bio-based, zero-thickness adhesive and its application to densified pine wood <b>(EM24_9)</b>  Sh Jalali (INEGI, Portugal), CSP Borges, RJC Carbas, EAS Marques, LFM da Silva	Challenges on extrusion-based additive manufacturing of thermoplastic polyurethane <b>(EM24_49)</b>  M Sardinha, L Ferreira, T Ramos, L Reis, MF Vaz (University of Lisbon, Portugal)
18:00	Bridging reliability and performance in semiconductor manufacturing: Insights into bi-material interfaces <b>(EM24_12)</b>  A Akhavan-Safar (INEGI, Portugal), R Ferreira, RJC Carbas, EAS Marques, B Karunamurthy, LFM da Silva	Production of wire frame structures by WAAM <b>(EM24_83)</b>  DG Andrade, C Zhu, H Miranda, DM Rodrigues (University of Coimbra, Portugal)
19:00	Poster session and RECEPTION	
COMPOSITES MANUFACTURING		
Machining		
Poster 1	A review of injection-mold materials and their conventional and non-conventional machining processes <b>(EM24_5)</b>	FR Nogueira, AFV Pedroso (Polytechnic of Porto, Portugal), VFC Sousa, NPV Sebbe, RDSG Campilho, FJG Silva, RCM Sales-Contini, MLS Barbosa
Poster 2	Study of surface finishing in the longitudinal turning process by vibration analysis in AISI 4340 annealed <b>(EM24_90)</b>	LP Silva (Pontifical Catholic University of Minas Gerais, Brazil), GC Silva, Y Pacheco
Poster 3	A novel cheap and flexible tool to minimize the waste of raw materials in the manufacturing of abrasive products <b>(EM24_36)</b>	J Pereira, FJG Silva, RDSG Campilho, RP Martinho, RCM Sales-Contini (Technological College of São José dos Campos, São Paulo, Brazil), AFV Pedroso, NPV Sebbe
Forming		
Poster 4	The influence of cross-wedge rolling on the microstructure of railway axles made of EA1N steel <b>(EM24_92)</b>	T Bulzak (Lublin University of Technology, Poland), T Kusiak, K Lis, Ł Wójcik
Poster 5	Comparative analysis of two methods of rolling rail axle forgings <b>(EM24_93)</b>	G Winiarski (Lublin University of Technology, Poland), T Bulzak, Ł Wójcik, K Lis
Poster 6	Analysis of the effect of tapered roll geometry on the parameters of the skew rolling process of a railway axle forging <b>(EM24_94)</b>	K Lis (Lublin University of Technology, Poland), T Bulzak, T Kusiak, Ł Wójcik, G Winiarski
Poster 7	Fatigue analysis of a cross wedge rolled rail axle <b>(EM24_95)</b>	L Wójcik (Lublin University of Technology, Poland), G Winiarski, T Bulzak, K Lis
Poster 8	Modelling material fracture using a new damage criterion in metal forming processes <b>(EM24_96)</b>	J Tomczak (Lublin University of Technology, Poland), T Bulzak, Z Pater
Poster 9	Fatigue analysis of the material of a railway axle manufactured in a CNC rolling mill <b>(EM24_97)</b>	T Kusiak (Lublin University of Technology, Poland), T Bulzak, K Lis, Ł Wójcik, G Winiarski
Additive manufacturing		
Poster 10	Application of additive manufacturing to microbiobial fuel cells <b>(EM24_69)</b>	R Dorado-Vicente (University of Jaén, Spain), E Torres-Jiménez, G Medina-Sánchez, T Kegl
Poster 11	Numerical and experimental study of out-of-plane compression behaviour of honeycomb structures with mass gradient produced by additive manufacturing <b>(EM24_81)</b>	T Rua, E Copin, AM Deus, MF Vaz (University of Lisbon, Portugal)



## Joining

Poster 12	Establishment of the fracture behaviour of a film adhesive using the direct method <b>(EM24_7)</b>	<u>BD Simões</u> (INEGI, Portugal), DS Correia, EAS Marques, RJC Carbas, LFM da Silva
Poster 13	A novel approach to reinforce wooden substrates with bio-adhesive for single lap joints <b>(EM24_10)</b>	<u>Sh Jalali</u> (INEGI, Portugal), CSP Borges, RJC Carbas, EAS Marques, LFM da Silva
Poster 14	Adhesive flow analysis in manufacturing hybrid bolted/bonded joints <b>(EM24_13)</b>	F Ricca, <u>A Akhavan-Safar</u> (INEGI, Portugal), RJC Carbas, EAS Marques, LFM da Silva
Poster 15	The performance of adhesive joints with hybrid adherends <b>(EM24_15)</b>	<u>RJC Carbas</u> (INEGI, Portugal), EAS Marques, LFM da Silva
Poster 16	Development and study of a new silane based polyurethane hybrid flexible adhesive - Mechanical characterization, joint testing and numerical modelling <b>(EM24_17)</b>	<u>VC Rodrigues</u> (INEGI, Portugal), EAS Marques, RJC Carbas, M Youngberg, A Dussaud, R Beygi, LFM da Silva
Poster 17	A comprehensive review exploring the improvement of fatigue life and strength in adhesively bonded composite joints <b>(EM24_20)</b>	<u>H Malekinejad</u> (INEGI, Portugal), RJC Carbas, EAS Marques, LFM da Silva
Poster 18	Joining of aluminium/steel sheets with dissimilar thicknesses by FSW: Joint design and mechanism of welding <b>(EM24_27)</b>	TOG Teixeira, <u>R Beygi</u> (Arak University, Iran), RJC Carbas, EAS Marques, LFM da Silva
Poster 19	Electrically assisted solid-state spot joining of cast aluminum alloy A365-T6 <b>(EM24_40)</b>	VC Phan, H-S Choi, <u>S-H Choo</u> (University of Ulsan, Republic of Korea), TT Do, T-AB Thi, S Basak, S-T Hong
Poster 20	Fatigue performance of adhesive joints in engineering structures: the impact of temperature and loading mode <b>(EM24_48)</b>	<u>M Ribas</u> (INEGI, Portugal), A Akhavan-Safar, RJC Carbas, EAS Marques, S Wenig, LFM da Silva
Poster 21	Failure analysis of hybrid busbars produced by a novel joining process <b>(EM24_54)</b>	<u>BFA Silva</u> (University of Porto, Portugal), MM Kasaei, A Akhavan-Safar, RJC Carbas, EAS Marques, LFM da Silva
Poster 22	Characterization of mechanical properties of commercial adhesives applied in the equestrian sector <b>(EM24_74)</b>	<u>CMC Ferreira</u> (INEGI, Portugal), VCMB Rodrigues, BD Simões, EAS Marques, RJC Carbas, LFM da Silva
Poster 23	Adhesives in veterinary medicine: a review <b>(EM24_75)</b>	<u>CMC Ferreira</u> (INEGI, Portugal), BD Simões, EAS Marques, RJC Carbas, LFM da Silva

## Optimization of manufacturing processes

Poster 24	Study of the influence of different quenching oils on the hardness and microstructure of carburizing steels <b>(EM24_3)</b>	M Tavares, P Duarte, P Canhola, <u>J Lino Alves</u> (University of Porto, Portugal)
Poster 25	A genetic algorithm approach to solve a textile job scheduling problem, aiming tardiness minimization <b>(EM24_1)</b>	<u>TB Cepeda</u> (Citeve, Portugal), I Gomes, JN Oliveira, J Silva, C Silva
Poster 26	Design of a connector assembly equipment for the automotive industry <b>(EM24_42)</b>	PMP Curralo, <u>RDSG Campilho</u> (Polytechnic of Porto, Portugal), JAP Pereira, FJG Silva
Poster 27	Metal equipment for producing high-purity materials for OLED technology <b>(EM24_53)</b>	<u>AD Barkanov</u> (Russian Academy of Sciences, Russia), VA Solomatina, SA Paveliev, ICh Avetissov
Poster 28	Numerical simulation of CdTe crystal growth by VGF technique assisted by axial low-frequency oscillations of the melt <b>(EM24_56)</b>	O Nefedov, A Dovnarivich, V Kostikov, E Mozhevitina, D Bocharnikov, <u>I Avetissov</u> (D Mendeleev University of Chemical Technology of Russia, Russia)

**Room B032**

- 8:40\* Comprehensive analysis of the dual role of the yield criterion in the numerical simulation of aluminium sheet metal forming processes (**EM24\_73**)  
**MC Oliveira** (University of Coimbra, Portugal)

**Session 5 – Forming II**

(Chair: LF Menezes and A Brosius)

**Room B032**

- 9:20 Formability limits by local buckling in thin-walled tubes with square cross-sections (**EM24\_76**)  
**IM Almeida** (University of Lisbon, Portugal), JPG Magrinho, MB Silva, PAF Martins
- 9:40 Assessment of the fatigue performance of forging die steels in corrosive and lubricant media (**EM24\_45**)  
E Calvo-García, S Valverde, A Riveiro, D Álvarez, M Román, C Magdalena, P Pou-Álvarez, A Badaoui, P Moreira, **R Comesaña** (University of Vigo, Spain)
- 10:00 Hole hemming of hybrid busbars in electric vehicle batteries (**EM24\_32**)  
DPM da Costa, **MM Kasaei** (INEGI, Portugal), RJC Carbas, EAS Marques, LFM da Silva
- 10:20 Numerical and experimental investigation on the material flow in an orbital forming process to join functional components from dissimilar materials (**EM24\_84**)  
**A Harms** (Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany), A Hetzel, M Lechner, M Merklein

**10:40-11:00 COFFEE BREAK****Session 6 – Various manufacturing processes**

(Chair: MF Vaz and R Comesaña)

**Room B032**

- 11:00 Environmentally friendly additive manufacturing of glass and glass-ceramics by laser assisted technology (**EM24\_44**)  
**R Comesaña** (University of Vigo, Spain), J del Val, O Barro, M Fernández-Arias, A Riveiro, E Calvo-García, F Quintero, M Boutinguiza, F Lusquiños, J Pou
- 11:20 The use of zirconia masks produced by FFF technologies in plasma spray projection applications (**EM24\_85**)  
**S Barbeiro** (University of Lisbon, Portugal), M Leite
- 11:40 Comparative analysis of mechanical properties in dental prosthetics: Laser directed energy deposition vs. Traditional fabrication techniques (**EM24\_62**)  
**O Barro** (University of Vigo, Spain), F Arias-González, F Lusquiños, R Comesaña, D Wallerstein, F Gómez-Baño, J Pou
- 12:00 Predicting residual distortion and stress in parts produced by laser-powder bed fusion using the inherent strain method (**EM24\_70**)  
BM Marques, **DM Neto** (University of Coimbra, Portugal), MC Oliveira, JL Alves, LF Menezes
- 12:20 Rapid precipitation and strength restoration of AA6061-T6 under artificial aging assisted by electropulsing treatment (**EM24\_37**)  
**ML Geng** (University of Ulsan, Republic of Korea), LH Cai, YX Zhao, TA Bui-Tui, YJ Kim, HN Han, S-T Hong
- 12:40 Adhesive joining technology in manufacturing engineering structures: Effects of loading mode and service temperature on fracture behaviour (**EM24\_47**)  
**M Ribas** (INEGI, Portugal), A Akhavan-Safar, RJC Carbas, EAS Marques, S Wenig, LFM da Silva

**13:00-14:00 LUNCH BREAK****Room B032**

- 14:00\* Joining dissimilar materials with very different properties using a novel process based on plastic deformation (**EM24\_64**)  
**M Kasaei** (INEGI, Portugal), RJC Carbas, EAS Marques, LFM da Silva

## Session 7 – Joining II

(Chair: EAS Marques and IMF Bragança)

### Room B032

- 14:40 Approach for reproducible and low deformation diffusion bonding of parts with arbitrary geometries **(EM24\_22)**  
T Gietzelt (Karlsruhe Institute of Technology, Germany), V Toth, M Kraut
- 15:00 Development of novel welding processes for high performance multi-material applications **(EM24\_23)**  
EAS Marques (University of Porto, Portugal), R Beygi, RJC Carbas LFM da Silva
- 15:20 Numerical analysis of FSW of Aluminum to steel with dissimilar thicknesses **(EM24\_30)**  
A Omid, R Beygi (Arak University, Iran), G Eisaabadi, EAS Marques, RJC Carbas, LFM da Silva
- 15:40 A new deformable self-clinching fastener **(EM24\_29)**  
JPM Pragana, RFV Sampaio, RG Clara, IMF Bragança (Instituto Politécnico de Lisboa, Portugal), CMA Silva, PAF Martins

16:00–16:20 **COFFEE BREAK**

## Session 8 – Optimization of manufacturing processes

(Chair: M Kasaei and RDSG Campilho)

### Room B032

- 16:20 A new design of metal injection system overcoming sprue backflow problems **(EM24\_35)**  
P Leitão, FJG Silva, RDSG Campilho, AFV Pedroso, NPV Sebbe, RCM Sales-Contini (Technological College of São José dos Campos, São Paulo, Brazil), AG Pinto
- 16:40 Automating the manufacturing process of control cables for the automotive components industry **(EM24\_41)**  
JPM Pinto, RDSG Campilho (Polytechnic of Porto, Portugal), FJG Silva
- 17:00 Assessing complexity in industrial 3D scanning: A methodological approach to geometrical feature classification in product inspection **(EM24\_78)**  
C Lin (Queen's University Belfast, UK), MAA Rahman, PG Maropoulos
- 17:20 The Integrated Design Management (IDM) tool **(EM24\_79)**  
V Carneiro (University of Porto, Porto, Portugal), A Barata da Rocha, B Rangel, JL Alves
- 17:40 Exploratory analysis and development of sustainable Lean Six Sigma methodologies integration for effective operation and risk mitigation in manufacturing sectors **(EM24\_89)**  
CD Ezeliora (Nnamdi Azikiwe University, Nigeria), CE Chuka, CC Okpala

20:00 **EM2024 BANQUET (Porto caves Calém)**