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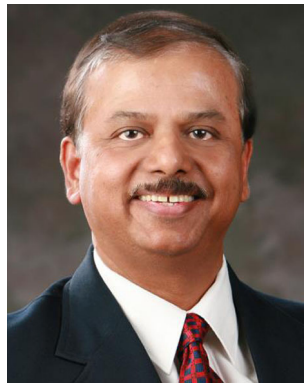
EDITORIAL

Announcing the *Journal of Materials Engineering and Performance* 2023 Editor's Choice Selections



Dear Reader,

The year 2023 marks the tenth anniversary of the tradition of highlighting Editor's Choice articles for *JMEP*. I am pleased to share with you these 2023 Editor's Choice selections. As in previous years, Bill Frazier, *JMEP's* Editor, joined me in selecting the articles.

"Editor's Choice" recognizes published scientific works for their quality, unfolding promise, and potential impact. We consider scientific quality, download and citation statistics, currentness, and topical diversity, among other factors, to make our selections. The task to identify six papers out of nearly 1,000 published papers is inspiring and challenging. Each published paper exemplifies a level of excellence and distinction, having withstood critical scrutiny by anonymous peers.

The Editor's Choice picks are free access and highlighted on *JMEP's* home page under "Journal updates." The authors receive congratulatory letters to recognize their contribution.

Below are the six papers that we selected as 2023 Editor's Choice picks. These articles can be downloaded at https://link.springer.com/journal/11665/updates/17308756.

Post-Process Treatments for Additive-Manufactured Metallic Structures: A Comprehensive Review

Jun Ge, Selvum Pillay, and Haibin Ning
J. of Materi Eng and Perform **32**(16), 7073–7122 (2023)
https://doi.org/10.1007/s11665-023-08051-9

Additive Manufacturing in the Context of Repeatability and Reliability

Federico Venturi and Robert Taylor
J. of Materi Eng and Perform **32**(15), 6589–6609 (2023)
https://doi.org/10.1007/s11665-023-07897-3

Resistance of Quench and Partitioned Steels Against Hydrogen Embrittlement

Hamdi Elsayed, Andreas Drexler, Fernando Warchomicka, Ines Traxler, Josef Domitner, Matthew Galler, Rudolf Vallant, and Christof Sommitsch
J. of Materi Eng and Perform **32**(11), 5186–5200 (2023)
https://doi.org/10.1007/s11665-022-07438-4

On the Heat Treatment of Selective-Laser-Melted 316L

Iuliia Morozova, Christian Kehm, Aleksei Obrosov, Yitong Yang, Kamal Uddin Mohammad Miah, Elena Uludintceva, Sebastian Fritzsche, Sabine Weiß, and Vesselin Michailov
J. of Materi Eng and Perform **32**(10), 4295–4305 (2023)
https://doi.org/10.1007/s11665-022-07404-0

Energy Absorption Characteristics of Fused Deposition Modeling 3D Printed Auxetic Re-entrant Structures: A Review

Niranjan Kumar Choudhry, Biranchi Panda, and Uday Shanker Dixit
J. of Materi Eng and Perform **32**(20), 8981–8999 (2023)
https://doi.org/10.1007/s11665-023-08243-3

A Review of High-Strength Aluminum-Copper Alloys Fabricated by Wire Arc Additive Manufacturing: Microstructure, Properties, Defects, and Post-processing

Siyue Fan, Xuming Guo, Zhenhua Li, Jing Ma, Fei Li, and Qingwei Jiang
J. of Materi Eng and Perform **32**(19), 8517–8540 (2023)
https://doi.org/10.1007/s11665-023-08233-5

The article by Ge et al., from University of Alabama, Birmingham, is a comprehensive review on post-processing of additively manufactured metallic structures. The authors highlight the promise and potential of hot pressing, conventional and non-conventional heat treatment, surface post-processing using lasers, impact treatments, and various other processes to minimize defects and enhance the properties and performance of built metallic structures. They highlight the need to evaluate survivability and functionality of post-process treated AM-built structures under real-life conditions and advocate the need to integrate AI/machine learning to optimize manufacturing process parameters and in-situ health monitoring tools and techniques to track performance in production and service. The authors conclude that synergistic effects of multiple types of post-processing treatments need to be understood and guidelines to select proper post-treatments developed to mitigate structural failure and lower the cost associated with post-processing.

Venturi and Taylor, from University of Texas at Arlington, highlight the need for research into variability, reliability, and design capabilities of additive manufacturing. The authors review issues surrounding repeatability, verification, and certification of AM processes and components to accelerate industry adoption of AM beyond prototyping. They highlight the importance of identifying, quantifying, and controlling variability. They note that evolving nature of and certain constraints with AM manufacturing make it difficult to employ conventional test methodologies and standards to ensure repeatability. They emphasize the need to develop and implement calibration procedures, in-situ monitoring systems, and statistical and quantification methodologies to win the trust and confidence of the designer and manufacturer.

In their paper on hydrogen embrittlement of an ultra-high strength 20Mn-Si steel, Elsayed et al., from Graz University of Technology in Austria, study the influence of Quench and Partitioned (Q&P) heat treatment parameters on the mechanical properties and on the hydrogen embrittlement (HE) behavior. They relate the mechanical behavior and HE response to volume fraction, nucleation, and morphology of retained austenite characterized using SEM, EBSD, XRD, and TEM. They continuously in-situ monitor the hydrogen charging during mechanical loading by attaching an electrochemical cell to a tension tester. They report that Q&P treatment does not alter the mechanical properties, but the HE threshold stress significantly increases. The findings are important for the automotive industry where use of Q&P steels for crash-relevant body-in-white components has been limited due to propensity for hydrogen embrittlement of such steels.

Manufacturing complex, high-density structural components from 316L austenitic stainless steel using selective laser melting (SLM) is attractive because of the possibility to achieve superior strength and ductility. But there is controversy about the effect of post-SLM heat treatment on the properties of printed 316L SS, with some studies showing improvement in ductility whereas others show a deterioration. Morozova et al., from Brandenburg University of Technology in Germany, report the effect of heat treatment temperature and time on metallurgical structure and mechanical properties of SLM 316L SS. They note that SLM and post-SLM treatment conditions significantly alter the phase evolution and increase the elongation but also decrease the strength because of reduced dislocation density and homogenization of the grain structure. The results are important to additive manufacturing of complex biomedical parts using this corrosion-resistant steel.

Choudhry et al., from Indian Institute of Technology, Guwahati, focus on the energy absorption capabilities and functional performance of complex auxetic materials manufactured using fused deposition modeling (FDM). The negative Poisson's ratio of auxetic materials, together with FDM's capability to tailor periodic or ordered microstructures, make such materials suitable for biomedical, automotive, and sports applications. The authors highlight future research needs to mitigate porosity, poor adhesion, poor surface finish, and a lack of isotropic properties that are caused by layer-wise manufacturing and multiple interfaces in multi-material auxetic structures. They emphasize the importance of studying energy absorption and deformation of printed re-entrant structures by integrating classical numerical methods with emerging machine learning and artificial intelligence approaches.

Fan et al., from Kunming University of Science and Technology and Shenyang Aerospace University in China, review solidification microstructure, mechanical properties, common defects, and post-processing of high-strength Al–Cu alloy products fabricated using Wire Arc Additive Manufacturing (WAAM). WAAM's capability to economically produce large-sized components at high rates positions it as an efficient production technology for aerospace, military, and automotive applications. The authors also review emerging approaches such as hybrid WAAM-interlayer rolling to improve the strength and ductility by minimizing defects such as inhomogeneous structure, porosity, micro-cracks, residual stress, and anisotropic properties. They highlight the need to mitigate the high cost of hybrid WAAM, address the challenges of increased processing parameters, and overcome the limitations on part complexity to competitively position the process for effective use in industry.

I encourage you to take time to view these six articles, as well as Editor's Choice selections from previous years at the journal homepage. Editor's Choice articles represent the high-quality content the journal publishes and capture the diversity of topics that enrich the discipline and define the journal. I hope the collective knowledge embedded in these papers shall stimulate fresh thinking and encourage the practitioners to transform the scientific discoveries into innovative processes and technologies.

Best Wishes!

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