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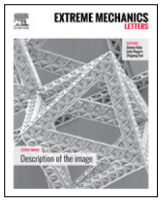

Editorial for the focus issue on "Mechanics in Extreme Manufacturing" in Extreme Mechanics Letters

It is our great pleasure to present the Extreme Mechanics Letters themed issue on *Mechanics in Extreme Manufacturing*. Manufacturing, which appeared as a labor-intensive handicraft exercise centuries ago, has shifted to an information-rich digital technique over the past few decades, where mechanics, as a discipline, has demonstrated a foundational role in the process of material choice and manufacturing optimization through the probing of deformation and failure in materials. As further evolution of manufacturing toward smart, flexible, and customizable, mechanics is expected to play a leading role in the refinement of the existing manufacturing techniques and the guidance of emerging new approaches. This special issue attempts to investigate and explore the mechanics in extreme manufacturing, where the adjective "extreme" is intended to highlight the central and driving factor (i.e. small scale, high stress, temperature, and/or deformation) of mechanics in the origins of new manufacturing techniques and methods beyond the current practice.

In this special issue, we have thirteen papers including one perspective paper and twelve research papers (categorized into three groups). It starts with the perspective paper written by Xu and Rogers that presents an insight from mechanics to drive fundamentally new approaches in extreme manufacturing by highlighting several achievements, along with discussion on future opportunities and challenges.

The first group of papers focuses on the mechanics-driven manufacturing of membranes, sheets, wires, and nanoparticle-based structures. Yang et al. report the fabrication of a periodically porous pH-sensitive hydrogel membrane by replica molding of a pre-stretched mold, and advance a robust method for controlling its chiral structures, at different pH values, by adjusting directions of pre-stretching. By stretching a viscoelastic polymer substrate, where gallium-based liquid metals are dispensed, Dickey et al. demonstrate a facile method of fabricating metallic wires at room temperature that is hundreds of degrees lower than those previously reported in literatures. Wang et al. discuss the growth of nanometer-thick single-crystalline ZnO nanosheets using an adaptive ionic layer epitaxy technique. Processing at the water–air interface, beyond van der Waals interactions, leads to ZnO nanosheets with a controlled morphology. Using molecular dynamics simulations, Niu et al. investigate assembly of zirconia nanoparticles under ultrasonication treatments. Their findings will guide and facilitate manufacturing of ceramic nanoparticles through ultrasonication. Tomar et al. study the consolidation kinetics of powder particles during sintering, using phase field modeling, to uncover microstructural changes of manufactured polycrystalline structures. By employing many-body dissipative particle dynamics, Yong et al. simulate evaporation of liquid–vapor interfaces, with adsorbed nanoparticles, and shed light on the manufacturing of nanoparticle-based thin films and coatings.

The second group of papers demonstrates the manufacturing of functional structures and surfaces and their applications in extreme environments. Barthelat et al. report a top-down manufacturing method by engraving weak interfaces of three-dimensional (3D) structures with the help of laser cutting. The manufactured material exhibits significantly enhanced failure resistance and damage tolerance to impact. Vaziri et al. propose a novel interlocking method to manufacture carbon fiber reinforced 3D composite grids with interconnected void spaces. Their experiments show that the manufactured structures can achieve higher specific energy absorption capacity than that of square honeycombs. Through a dimensionless parametric study, Johnson et al. present a theoretical framework to explain material removal during focused ion beam (FIB) processing, and demonstrate the potential to enhance FIB as a tool to modify surfaces of materials during nanomanufacturing. Croom et al. report a 3D digital image correlation (3D-DIC) based method and probe the residual stresses in air plasma spray coatings. These results can contribute to the development of real-time and in-situ monitoring of stresses in manufacturing.

The third group of papers introduces mechanics of transfer printing and its applications. Lu et al. present an

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analytical model and successfully reveal the in-plane stress of nanomembranes induced by a transfer printing process. Using the transfer printing technique, Kim et al. discuss fabrication of a soft composite film with a tunable surface topography under uniaxial tension.

This collection of papers, though just a sampling of this emerging field, attempts to illustrate the leading role of mechanics in extreme manufacturing. We hope this special issue can serve as a catalyst to accelerate the extension of manufacturing to extreme conditions to meet emerging needs in smart, flexible, and on-demand manufacturing. We look forward to continuous and stimulating advances in this challenging but exciting field.

In closing, we would like to sincerely thank all authors and reviewers of this special issue for their enthusiastic and timely response, the EML staffs, especially Grace Lv and Krishnaveni Kunchala, and EML Editors-in-Chief for their support of this special issue.

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