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EDITORIAL

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Editorial: Special Issue on Materials for Extreme Environments, Part 1

Reference

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Limits on materials behavior are among the greatest technical obstacles to improving the safety and reliability of engineering systems. When subjected to extreme environments, materials can behave in unexpected and unpredictable ways. The need to develop materials that can perform well in severe operating environments is a major challenge for materials scientists, and it requires a fundamental understanding of material response under extreme conditions of heat flux, stresses, strain rates, and corrosive environments. Chemical and physical processes must be probed, understood, and controlled at different length scales, over varying time periods for successful development of materials for engineering applications. Further, understanding and exploiting extreme environments is critical for meeting the demanding applications in diverse areas of engineering research for creating new materials, that not only survive but also function under the challenging conditions.

It has been a real pleasure to be guest editors for the *Materials Performance and Characterization* two-part special issue on Materials for Extreme Environments. The call for papers attracted a large number of abstracts from leading scientists and engineers for these special issues. After scrutiny and their acceptance, a total of 48 full-length manuscripts have been submitted for consideration.

The first part of this two-part special issue covers 16 papers that were submitted and subjected to the peer review process, performed by experts from the respective fields. Importantly, the issue consists of three review articles, authored by eminent researchers that are of significant addition to this volume. The first article, by Prof. Osamu Umezawa, is an authoritative review on the mechanical properties of high strength alloys at cryogenic temperatures. In his illustrious career, he has immensely contributed to the cryogenic testing procedures and to the understanding of fatigue and fracture of several structural materials operating at cryogenic temperatures. The second article is a review of steels for cryogenic applications from the materials researchers of the Indian Space Research Organization. This article presents an exhaustive study of different classes of steels used for cryogenic applications including recent advances in materials such as high entropy alloys and those processed through additive

manufacturing for applications down to 4K. The third article is a review on processing of ZrB_2 and HfB_2 based ultra-high temperature ceramic materials from the research group of Homi Bhabha National Institute, India. This article discussed the challenges involved in the fabrication of dense di-borides for leading edge applications in hypersonic vehicles.

This is followed by 13 manuscripts describing the latest advances in materials for extreme environments. A very interesting article by Perepezko et al. on Mo-Silicide alloys for high temperature structural applications brings out the latest developments in these classes of materials. Advanced materials and manufacturing technologies for gas turbines, creep, creep-fatigue, high strain rate behavior of different types of materials, fibers for high temperature applications, coatings for functional applications, C/SiC fasteners for high temperature applications, fire resistant steels, welding, and tribological properties of superalloys are presented in subsequent manuscripts. These articles describe the latest advances in the materials for extreme environments.

We sincerely thank both the authors and reviewers for their hard work and dedication. We wholeheartedly thank the ASTM staff dealing with the issues related to the process of publishing an outstanding journal.

We sincerely hope that you enjoy these papers and look forward to the second part of this special issue that is currently under processing.