ADDITIVE MANUFACTURING

Agile Additive Manufacturing by Employing Breakthrough Functionalities

The development of breakthrough functionalities has enabled additive manufacturing (AM) technologies to be more agile and impactful across a wide range of applications, from heat exchangers and rotating low pressure turbine blades to large scale expendable rocket bodies. AM also provides a tremendous opportunity to synergistically couple materials, design, and manufacturing strategies, where one can strive towards fabricating parts with targeted site-specific properties. For example, a combinatorial approach for zone-based hybrid microstructural evolution may be achieved by employing multi-material alloying and multi-modal manufacturing strategies. Other examples include overcoming mismatches in thermal expansion coefficients, controlling residual stress and/or achieving desirable microstructure in heat treated multi-material builds.

The purpose of this symposium is to present the latest developments that explore and possibly integrate the following breakthrough AM functionalities:

- Functionally Graded Materials: use of multi-material builds via sequential or simultaneous injection of raw materials, or single material with dramatically different process conditions for tailored hybrid microstructures.
- Metamaterials: topological and/or shape optimization to exploit light-weighting and enhanced property response.
- Multi-modal manufacturing: integrating additive with conventional manufacturing techniques, such as additive + subtractive + transformative (i.e. impact or laser peening) processes, and/or external fields, e.g., electromagnetic, ultrasound, etc., to achieve the right balance among materials properties, part resolution and build efficiency.
- Advances in hardware, process monitoring, process control methods, and inspection technologies to enable breakthrough functionalities.
- Case studies using breakthrough functionalities to build large or highly complex components.

The symposium encompasses all AM modalities, such as Laser or E-Beam based powder bed fusion (PBF) and large-scale DED processes. Studies on processing-structure-property assessments of structural and functional materials by coupling multiscale experimental and modeling strategies are encouraged.

ORGANIZERS
Soumya Nag, Oak Ridge National Laboratory, USA
Jonah Klemm-Toole, Colorado School of Mines, USA
John Carpenter, Los Alamos National Laboratory, USA
Peeyush Nandwana, Oak Ridge National Laboratory, USA
Lang Yuan, University of South Carolina, USA
Alex Kitt, Edison Welding Institute, USA
Sougata Roy, Iowa State University, USA
Sneha Prabha Narra, Carnegie Mellon University, USA
Andrzej Nycz, Oak Ridge National Laboratory, USA
Yousub Lee, Oak Ridge National Laboratory, USA
Chantal Sudbrack, National Energy Technology Laboratory, USA
Albert To, University of Pittsburgh, USA
Yashwanth Kumar Bandari, AddiTec Technologies LLC, USA

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