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# TMS 2025

154th Annual Meeting & Exhibition

**March 23–27, 2025**
MGM Grand Las Vegas
Hotel & Casino
Las Vegas, Nevada, USA
#TMSAnnualMeeting

## SUBMIT AN ABSTRACT FOR THE FOLLOWING TMS2025 SYMPOSIUM:

### ADDITIVE MANUFACTURING

## Additive Manufacturing: Incorporating Breakthrough Functionalities for Building Large Scale Components

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**

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

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**QUESTIONS?**
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