Final Technical Report – 7th World Congress on Integrated Computational Materials Engineering (ICME 2023)

Integrated Computational Materials Engineering (ICME) has garnered international attention for its potential to shorten product development time, reduce costs, and enhance design and manufacturing outcomes. ICME uses computer modeling to predict materials behavior, integrating this information into the materials, processing, and manufacturing design cycle. The 7th World Congress on Integrated Computational Materials Engineering (ICME 2023), held in Orlando, Florida from May 21–25, 2023, convened stakeholders across modeling, simulation, experimentation, and design, from academia, government, and industry, to discuss ICME tools and techniques and their application in engineering.

This congress fostered valuable interactions among experimentalists, modelers, and computational and design experts, providing a forum for leaders to showcase research, network, and advance ICME knowledge. The organizers aimed to ensure a high-quality event with a strong international presence, focusing on significant advances in ICME on a global scale. ICME 2023 also served as a central hub for software developers, process engineers, materials scientists, and engineers involved in the full production chain. It remains the only congress uniting stakeholders from diverse disciplines and nations to address integration priorities and gaps essential to advancing ICME. Student participation was actively encouraged to expose students to the latest developments in the field. This inclusive meeting brought together attendees from research, industry, and education to provide the most advanced technical conference possible.

This congress provided a forum for presentations and discussions centering on ICME-related topics, including: (1) The wide range of materials programs where an ICME approach validated by experimental efforts is applicable, including computational- and experimental-based talks; (2) Individual computational methods utilized in an ICME approach, including both advantages and limitations; (3) Incorporation of "big data, data fusion and machine learning" for materials and product development with ICME methodologies; (4) Verification, validation, and uncertainty quantification issues; and (5) Roles of ICME in continuing education in industry. The specific technical topics of ICME 2023 included: (1) Applications: Advanced Manufacturing (Additive, Hybrid, Metamorphic, etc.); (2) Applications: Materials Design and Modification; (3) Artificial Intelligence and Machine Learning; (4) ICME for Non-Metals, Structural Composites, and Ceramics; (5) ICME for Non-Metals, Structural Composites, and Ceramics; (5) ICME-Based Design Tools – Industrial Integration and Success Stories; (6) Linkage: Structure – Properties – Microstructure; (7) Materials Databases and Platforms; (8) New and Emerging Areas for ICME – Functional Materials and Energy Storage and Conversion; and (9) Scientific Workflows for ICME – Automated Processes and Data Capture with Tagging from Experiment and Computation). Moreover, this event brought together a wide array of researchers in this arena, including: scientists, engineers, managers, government program officers, professors, and students. This support helped to enable widespread dissemination of the important findings from this congress, which helped the community assess its current state and identify exciting directions the field could move in going forward.

The major activity associated with the project was a specialty conference held in Orlando, Florida from May 21–25, 2023. It was organized by a team of 7 core organizers committee members with the support of an international Advisory committee, as seen below:

The distinguished group of organizers developed and chaired this congress:
•	Will Joost, USA (Chair)
•	Danielle Cote, Worcester Polytechnic Institute, USA

- Kester Clarke, Colorado School of Mines, USA
- Javier Llorca, Technical University of Madrid and IMDEA Materials Institute, Spain
- Heather Murdoch, Army Research Laboratory, USA
- Satyam S. Sahay, John Deere Technology Center, India
- Mike Sangid, Purdue University, USA

In addition, the international advisory committee consisted of:
- Laura Bartolo, Kent State University, USA
- Hector Basoalto, The University of Sheffield, UK
- Allison Beese, Pennsylvania State University, USA
- Andrew Boyne, Pratt & Whitney, USA
- Carrie Campbell, National Institute of Standards and Technology, USA
- Amy Clarke, Colorado School of Mines, USA
- Imre Felde, Obuda University, Hungry
- Saryu Fensin, Los Alamos National Laboratory, USA
- B.P. Gautham, Tata Consultancy Services, India
- Shrikant Joshi, University West, Sweden
- Victoria Miller, University of Florida, USA
- Jian-Feng Nie, Monash University, Australia
- James Saal, Citrine, USA
- Georg J. Schmitz, MICRESS group at ACCESS, Germany
- Damien Tourret, IMDEA Materials Institute, Spain
- Manas Upadhyay, Ecole Polytechnique, France
- Qingyan Xu, Tsinghua University, China

The specific objective of this conference was to convene leading researchers and practitioners to share the latest knowledge and advances in the discipline. This congress is the recognized hub of interaction among software developers and process engineers along the entire production chain, as well as for materials scientists and engineers developing new materials. This is the only congress dedicated to bringing all stakeholders together from across nations, disciplines, and organizations to focus on integration priorities and gaps that need to be addressed in order to advance the field. The congress had 5 plenary and 13 invited presentations, 38 technical sessions with a max of 5 talks per session, and more than 200 attendees. TMS staff administered this award to support 12 presentation authors to attend and participate in this specialty congress. Ultimately, this activity helped to bolster the work of researchers within the ICME community, who have come together to assess the current state-of-the-art and roadmap crucial areas for future research within the field.

All attendees were encouraged to submit their work to the TMS journal Integrating Materials and Manufacturing Innovation, which will be publishing topical collections on Integrated Computational Materials Engineering (ICME). These collections take the place of a traditional conference proceedings publication. Only submissions from the 7th World Congress on Integrated Computational Materials Engineering (ICME 2023) attendees were considered for these collections. Participants in ICME 2023 have been strongly encouraged to contribute to this effort. To date, the conference has 161 presentations while the final number of conference papers is still to be determined.