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SIMULATION AND MODELING OF THE FATIGUE BEHAVIOR OF METAL ADDITIVE MANUFACTURED COMPONENTS

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ABSTRACT

The invited session entitled "Simulation and Modeling of the Fatigue Behavior of Metal Additive Manufactured Components" aims to address the critical challenges and advancements in understanding the fatigue behavior of components produced through metal additive manufacturing (AM). Metal AM technologies, such as selective laser melting (SLM) and electron beam melting (EBM), offer unparalleled design flexibility and material efficiency. However, the complex microstructures and residual stresses inherent to AM processes pose significant challenges to predicting and enhancing fatigue performance. The session will bring together leading researchers and industry experts to present their latest findings and methodologies in simulating and modeling the fatigue behavior of metal AM components. Key objectives include exploring advanced simulation techniques, such as finite element analysis (FEA) and crystal plasticity modeling, to predict fatigue life and failure mechanisms. The session will also delve into the impact of microstructural features, surface roughness, and residual stresses on fatigue performance, offering insights into optimizing AM processes for improved fatigue resistance. Presentations will cover a range of topics, including the development of multi-scale models that bridge the gap between microstructural characteristics and macroscopic fatigue behavior, the application of machine learning algorithms to enhance predictive accuracy, and the integration of experimental data with simulation results to validate models. Additionally, case studies demonstrating the successful application of these techniques in real-world scenarios will be highlighted. By fostering a comprehensive understanding of the fatigue behavior of metal AM components, this session aims to contribute to the advancement of reliable and durable AM technologies. Attendees will gain valuable knowledge on the latest simulation tools and strategies, paving the way for the development of high-performance AM components capable of withstanding demanding operational conditions.