Plenary Lecture

Room Town & Country A - Session PL-MoPL

Plenary Lecture: The Fundamental Physics of Spray Coatings and Surface Impacts: Unit Process Studies of Hypersonic Particle Impacts

Moderator: Samir Aouadi, University of North Texas, USA

8:00am **PL-MoPL-1 PLENARY LECTURE: The Fundamental Physics of Spray Coatings and Surface Impacts: Unit Process Studies of Hypersonic Particle Impacts***, Christopher A. Schuh (schuh@mit.edu)*, MIT, USA **INVITED**

Many surface treatment processes involve impact events, including abrasive spray, peening methods, or spray coatings. The fundamental physics behind such processes, including deformation, bonding, and coating development, however, remain mysterious; the impacts are extremely fast and involve microscopic particles, so that they are challenging to resolve. This talk will review a new line of research aimed at understanding the unit process of particle impacts at velocities into the supersonic range—we study individual ~5-50 μm particles and record their approach and impact with a substrate using an all-optical single-particle test method with nanosecond time resolution. For hard particles, this method leads to quantitative measures of plasticity at extreme rates (>10^7 s^{-1}). For metallic particles, it quantitatively reveals the changes in plasticity that occur as particles approach the threshold velocity for bonding, as well as other deleterious transitions such as impact-induced melting and erosion. When combined with post-mortem characterization, details on microstructural evolution in extreme conditions can be discerned, including, e.g., dynamic recrystallization by a new mechanism that emerges at high rates, or the fracture and delamination of nanoscopic surface oxide layers.

Author Index

Bold page numbers indicate presenter