

Quantitative studies of microparticle impacts: unique insights into microstructure evolution, erosion and bonding at the single-particle level

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Laser-induced particle impact testing (LIPIT) has emerged as a powerful technique for exploring material behavior under extreme strain rates and at small length-scales—conditions that are relevant to bonding and erosion processes in cold spray manufacturing. Our group uses LIPIT for the quantitative study of a wide range of single-particle impact phenomena. Here we present an overview of our most recent work, including 1) low-temperature dynamic recrystallization and grain-refinement in copper; 2) temperature dependence of impact-induced melting; 3) effects of temperature on the critical velocity for particle-bonding; 4) the influence of various heat treatments on the properties and bonding of aluminum alloy particles; and 5) our advances of the LIPIT methodology towards higher experiment temperatures and a reproducibility of the impact location better than typical particle diameters.