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Coalescence of Liquid Metal Droplets with application to metallic 3D printing RYAN MCGUAN, PIROUZ KAVEHPOUR, ROB CANDLER, UCLA
— In the field of additive manufacturing, printing functional metallic parts remains the penultimate challenge and goal of research and industry. Metals present many challenges due to high thermal conductivity, their tendency to oxidize and sensitivity to thermocapillary effects. Understanding and mitigating these variables is necessary for the process to become workable, scalable and economic. For droplet-based 3D printing, it is essential to study the liquid droplet coalescence on a planar surface presents a challenging crucible of physical forces including viscosity, capillarity, inertial and gravitational body force. This is further complicated in some substances, such as certain liquid and molten metals that undergo oxidation at the surface introducing a "quasi-film" confined to the air-metal or liquid-metal (in the case of surrounding the droplet with an immiscible liquid) interface. This oxidation layer introduces inhomogeneity of material properties at the surface, as well as interfacial phenomena that defy traditional models of surface tension or interfacial energy driven interactions. We investigated the coalescence of room temperature liquid metal and its unique features. The coalescence process is studied for metallic droplets with and without oxidation. We observed that many features of this phenomenon that differ from non-metallic drop coalescence.

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