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Solvent-Free Thermal Spraying of Polymer Particles MILAN IVOSEVIC, RICHARD A. CAIRNCROSS, Department of Chemical Engineering, Drexel University, Philadelphia, PA, RICHARD KNIGHT, Department of Materials Science and Engineering, Drexel University, Philadelphia, PA — During thermal spray deposition, jets of high temperature and high velocity gases are used to melt and accelerate particles towards the surface to be coated. Upon impact at the surface, multiple droplets deform, cool and consolidate to form a coating. A 3D model of particle impact and deformation on flat and rough surfaces has been developed for thermally sprayed polymer and metal particles. Fluid flow and particle deformation were predicted by the Volume of Fluid Method using Flow-3D software. A comparison between polymer and metal splatting demonstrates how the large physical property differences between these materials affect their flow behavior under similar thermal spray conditions. The higher viscosity of molten polymers leads to lower Reynolds numbers and less deformation, and lower thermal conductivity of polymers leads to higher Biot numbers and large temperature gradients in the polymer particles. Temperature gradients in a particle lead to a "fried egg" shaped splat characteristic of experimental observations of thermally sprayed polymer particles. The effect of roughness on the mechanics of splatting and final splat shapes was explored through the use of several prototypical rough surfaces, e.g. steps and grooves.

Milan Ivosevic
Department of Materials Science and Engineering
Drexel University, Philadelphia, PA

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