Microstructural Evolution Simulation for Property Prediction in Cold Spray Processing

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Dr. Cote is an assistant professor in Materials Science & Engineering at Worcester Polytechnic Institute with a joint appointment in Chemical Engineering. Her research involves computational thermodynamic and kinetic modeling applied to feedstock metal and wire development for additive manufacturing applications, in addition to novel multiscale materials characterization and data-driven materials science. As a result, she has received several early career research awards, as well a 2021 NASA Early Career Faculty award. In addition to research, Dr. Cote is actively involved in promoting diversity and inclusion in STEM fields, particularly in increasing retention rates among women in STEM careers.

Abstract

The cold spray process is a dynamic powder consolidation technique capable of producing materials with high strength and toughness through an extremely versatile processing system. In this solid state additive manufacturing process, the consolidated material and mechanical properties are directly dependent on the powder properties. Let's look at these powder properties! To account for this relationship, a through-process model was developed as a predictive tool to follow the microstructural evolution of the cold spray process – from as-received powder to post processing consolidated material. The significance of the feedstock powder properties becomes evident in this work and will be discussed in terms of kinetic, thermodynamic, and solidification predictive simulations and experimental characterization. The final model predicts material and mechanical properties of the consolidated material as a function of feedstock powder and process parameters. Examples of aluminum, steel, and refractory powders are demonstrated