**In-Situ STEM Observations of Phase Transformations and Grain Refinement in Single Cold Spray Splats**

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Cold Spray deposits and coatings have been studied extensively through the use of ex-situ heat-treatment and subsequent microscopy. Considerably less effort has been devoted to the study of these materials using *in situ* microscopy techniques. It is known that cold spray produces coatings and parts with a high degree of plastic deformation; coupled with the metastable microstructural state of the as-atomized powders, this leads to coatings that may behave rather differently than bulk cast or wrought analogues of the same material. In this work, we present proof-of-principle *in situ* scanning transmission electron microscopy (STEM) heating studies on the nature and kinematics of phase transformations and grain refinements in single cold spray splats. It is shown that static recrystallization happens extremely rapidly within a narrow band of highly-sheared material along the periphery of the splat. Secondary phase dissolution and coarsening are recorded and quantified through area fraction and equivalent radius measurements with respect to time during isothermal in-situ heat treatments. From these data, estimations of diffusion coefficients can be extracted in the interfacial region of single cold-spray splats. These experiments demonstrate the applicability and utility of *in situ* STEM heating experiments for determining the characteristics of various thermally activated phenomena that occur within cold-sprayed material.