

Numerical Investigation of Cold Spray Deposition Mechanisms of Polymeric Coating on Fiber Reinforced Polymer Composites

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Abstract:

Cold spray is a promising technique for coating and additive manufacturing of polymers and polymer-based composites. A significant advantage of cold spray over other coating methods is its ability to produce thick polymeric coatings on a wide range of substrates, including but not limited to polymer-matrix composites. This work investigates the underlying mechanisms leading to the deposition of cold sprayed nylon 6 on fiber (glass and carbon) reinforced composite substrates. The deposition mechanisms are explored using a multiscale finite element analysis. Modeling results suggest that, upon impact, the particles undergo larger plastic deformation without damaging the reinforcing fibers in the composite substrate. These results are validated by microstructural analyses performed on in-house fabricated samples, highlighting the role of severe plastic deformation of the seeding nylon layer as the dominant adhesion mechanism. Results obtained in this work highlight the promising potentials of cold spray as a novel coating process that can be used to produce thick polymer coatings on fiber composites without imposing significant damage to the substrate.

Keywords: Cold-spray, FRP, composites, polymer, coating.

Declaration of Competing Interest:

The authors declare no conflict of interest.