Cold Spray Analysis of Polymer-Coated Metal Particles on Polymeric and Composite Substrates

Nicholas Beau Mennie, Nand Kishore Singh*, Isaac Nault, Behrad Koohbor, Francis M. Haas, Ratneshwar Jha,

Department of Mechanical Engineering, Rowan University, 201 Mullica Hill Rd., Glassboro, NJ 08028, USA

* Corresponding Author, Email: singhnk@rowan.edu , Tel: +1-856-803-9942

Cold Spray is a useful technique for metallization of both polymer and carbon fiber-reinforced substrates. The substrate materials and cold spray technique to perform metallization are used in a variety of industrial applications such as aerospace, automotive, and wind energy. The current research looks into the metallization of these materials using the cold spray technique with the use of polymer-coated metallic particles. The bonding mechanisms of these polymer-coated metallic particles onto both neat PEEK substrates and carbon-fiber reinforced PEEK substrates were investigated using numerical modeling. Finite element analysis results suggest that bonding of polymer-coated metallic particles onto the substrates is possible due to the high energy impact and effective mechanical interlocking of the particle. Modeling data also indicate that the thickness of the surface epoxy layer present on the external surface of the composite substrates governs the deposition mechanisms and affects the success of cold spray deposition.

Keywords: cold spray, metallization, polymers, fiber-reinforced polymer, finite element analysis