Polymer cold spray is not limited to low spray velocities

Tristan W. Bacha[1,3], David A. Brennan[1,3], Francis M. Haas[2,3], Joseph F. Stanzione III[1,3]
bachat9@rowan.edu, brenna92@rowan.edu, haas@rowan.edu, stanzione@rowan.edu
[1] Rowan University Department of Chemical Engineering, Glassboro, NJ 08028
[2] Rowan University Department of Mechanical Engineering, Glassboro, NJ 08028
[3] Rowan University Advanced Materials and Manufacturing Institute, Glassboro, NJ 08028

Recently, interest in applying cold spray technology to polymer powders has been expressed in the literature [1-5]. Although a promising technology, polymer powders have proven to be challenging to spray with reports generally struggling to achieve efficient sprays and high deposition quality. Previous studies have focused on obtaining lower spray velocities and higher impact temperatures to successfully deposit polymer particles [2-9]. Our work demonstrates that the cold spray processing of polymers does not require warm particles impacting at low velocities to sucessfuly build deposits. Nylon 6 powder was deposited successfully using a custom low-pressure cold spray unit, and a commercially available high pressure cold spray unit. Multiphysics simulations of the process revealed that successful sprays are possible with particle impact velocities in the 1000 m/s range, and at particle temperatures substantially below the glass transition temperature of the polymer. Deposition efficiency, deposit hardness, and deposit density were found to increase with particle velocity. Increasing particle impact velocity was achieved by switching the process gas from either Nitrogen or air to helium. Moreover, the observed deposition efficiencies of ~90% are a major improvement from previously reported highs of ~15% [10]. This work is a substantial step forward in developing the polymer cold spray process to becoming an effective method of applying functional coatings, addive manufacturing, and repair.

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