

# **Particle Consolidation by Low Pressure Cold Spray: Modeling, Experiments and Applications**

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The results and applications of recent work at the University of Windsor will be presented. The mechanisms of particle consolidation by low pressure gas dynamic spray technology are analyzed in this work. The study describes the analysis of an air gas dynamic spray method with a radial injection of powder. The powder agglomerate formation processes is examined by SEM and EDX. To fully understand particle interactions with both substrate and neighboring particles, Finite Element Analysis (FEM) of particle agglomeration impact onto substrate is performed. The results obtained show the influence of particle agglomeration density on stress and strain distribution in the particles and at the particle interfaces. The results are compared with metallographic structures of real coatings.

In the application section, Low Pressure Cold Spray (LPCS) was used to produce Al based powder coatings on X80 low carbon steel, AA2024 Al alloy and AZ31 Magnesium alloy substrates. The corrosion protection provided by these coatings was evaluated by electrochemical measurements (polarization curves, electrochemical impedance spectroscopy) in 1M NaCl electrolyte. The microstructures and electrochemical behavior of the Al based coatings were investigated in comparison with pure Al. The electrochemical corrosion mechanisms of the coatings and microstructure were discussed. The coatings show a typical layered cold sprayed material structure.