Flow Characterization of Low-Pressure Cold Spray Systems

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Low-pressure cold spray (LPCS) offers many advantages compared to high-pressure cold spray such as lower operating costs and increased portability, but there can be limitations. By analyzing the characteristics of air and particle flow in a low-pressure cold spray (LPCS) system, operating conditions, and nozzle design can be optimized. The goal is to fabricate instrumentation to measure flow properties throughout the nozzle and delivery system of a LPCS device to validate Computational Fluid Dynamic (CFD) models. A test bench is being developed that will allow the measurement of total temperature and total pressure throughout the gas plume, delivery tube, and nozzle of a LPCS system. An optical Schlieren system has been designed and will be used to locate and identify shocks throughout the gas plume. Measurements of the temperature and pressure of the supplied gas and static pressure at the powder entry point in the nozzle will be taken. Particle imaging velocimetry methods are being discussed so that particle flow may be observed and modeled. Large Eddy Simulation (LES) 3D CFD models of the system are being created using ANSYS Fluent as well as in-house-developed CFD code and will be verified using the data obtained with the test bench. The findings can potentially improve low-pressure cold spray technology.