

UNDERSTANDING DIFFERENT FACTORS AFFECTING SUPERSONIC PARTICLE DEPOSITION (SPD) REPAIRED AL 7075-T651 PLATE FOR STRUCTURAL RESTORATION

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One of the main challenges in maintaining aging aircraft is to find a reliable, effective and economic repair process, for both non-structural and structural repairs. Supersonic particle technology (SPD) aka Cold Spray (CS) has proved to be an effective geometry restoration technology and has the potential to repair/restore/enhance the airworthiness of aging aircraft. Al 7075-T651 is highly susceptible for stress crossing cracking compared to -T7351 temper. Mechanism involved in environment assisted cracking (EAC) such as corrosion fatigue primarily in conventional product forms such as rolled plate, extrudate or forging in Al 7075 is complex. Fundamental research concerning the driving force and micro-mechanism involved in EAC is still not matured, and, not completely understood in Al alloys. In addition, the effect of different factors such as high strain rate deformed layers, residual stress in the coating and substrate and presence of micro defects makes more complex in understanding the EAC in SPD repair subjects. In light of the complex nature of the SPD structure, systematic evaluation was carried out to determine various factors affecting the EAC behavior of the SPD repair. Thus, this presentation focuses on a brief overview on the application of this technology for corrosion repair followed by experimental study and fractographic analysis of SPD repaired Al 7075-T651 0.25" plate aimed at restoring the structural functionality. To study the structural behavior of the SPD coated 7075 Al, both static and fatigue performance were evaluated in ambient and humid environment. The study involves simulating a 20% thickness loss by milling Al 7075 master plates (9.1" x 8.75") followed by depositing Al 7075 spray atomized powder using SPD process. Test coupons were extracted from this master plate; orientation and location of the individual test specimen origin were tracked. The presentation includes factors affecting the quality of the SPD coating specifically for structural application and how to exploit these factors in qualifying a SPD coating. Test results are validated and supported by detailed fractographic studies. Emphasis will be given to failure modes and mechanism involved on these SPD coated specimens tested under cyclic loads, and, under ambient and humid environments will be discussed.