

Micro- and Nano-mechanical Testing Techniques Applied to Cold Sprayed Coatings and Splats

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Both adhesion strength of coating to substrate and cohesion strength between sprayed particles are very important quantities that affect the mechanical integrity of a cold sprayed coating. While many methods exist to measure either of these quantities, there are some common drawbacks. For example, most methods require that significant amounts of powder be sprayed. Also, in the case of cohesion strength measurements, complex geometries and post machining are often required. We have recently developed two alternative test methods that use instrumented indentation and scratch testing. Both methods overcome the drawbacks mentioned above and have shown promising early results. The first technique, a modified ball shear test, determines adhesion strength of single cold spray splats to a substrate. The second technique, a combined method using nanoindentation and microindentation, determines a degree of indentation size effect in coatings that is related to cohesion strength. For both techniques, initial results for cp Ti showed increasing adhesion with increased in-flight particle velocity. An effect of gas pre-heat temperature on splat to substrate adhesion was also observed for conditions with lower in-flight particle velocities. Both test methods will be discussed in terms of their possible applicability for laboratory scale demonstration of the quality of cold sprayed material when compared to traditional bulk manufactured parts.