

SST COLD SPRAY TECHNOLOGY RESTORES HIGH-VALUE PRECISION GAUGING FIXTURES

REASON TO CONSIDER RESTORATION

Precision gauges and fixtures used to dimensionally check automotive components are typically made of heat-sensitive aluminum alloys using a variety of subtractive and/or additive manufacturing techniques. Due to the required precision, machining and finishing costs are often very high, and consequently any machining mistake can become cost prohibitive. In addition, recurrent use of the tool leads to unavoidable wear and tear, which eventually renders the tool unacceptable for the job, even though there may be considerable value remaining.

ISSUES

Aluminum alloys used to fabricate these components are specially heat treated. These materials are intrinsically sensitive to any process or procedure, such as welding or



Fig. 1 — Subtractive machining of a geometrically complex aluminum gauging tool for checking automobile polymeric shapes.

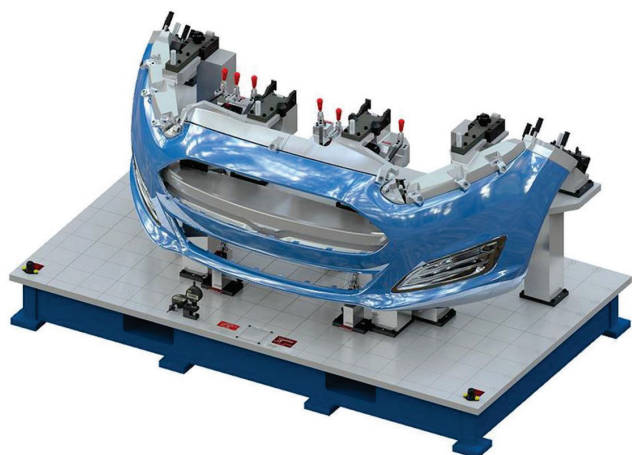


Fig. 2 — Finished check fixture for dimensionally validating a plastic front bumper.

conventional thermal spray, which create a heat affected zone (HAZ) on the substrate. Not only would the material properties in the HAZ become substandard, but the dimensional accuracy of the tool would be compromised due to thermal distortion.

OPTION

Supersonic spray technology (SST) cold spray enables metal consolidation that can dimensionally restore these tools with minimal or no thermal effects. Therefore, SST manual and robotic cold spray technology, which is operated at low pressures and temperatures, has become a reliable and effective tool in the industry (Fig. 3).



Fig. 3 — Commercial SST cold spray system. Courtesy of CenterLine Windsor Ltd.

Cold spray is a solid-state metal consolidation process that uses a high-speed gas jet to propel metal and other powder particles against a substrate where particles plastically deform and consolidate upon impact. The term *cold spray* refers to the relatively low temperature involved in the process, which is typically much lower than the melting point of the spray material and substrate. In the SST cold spray equipment, air can be used as a propellant gas and temperatures will be low enough not to thermally disturb the substrate material. After low-temperature dimensional restoration of the area, the newly consolidated material can be effectively machined back to tolerance using standard machining techniques.

BENEFITS

Since adhesion of the metal powder to the substrate and deposited material is achieved in the solid state, the characteristics of cold spray deposits are quite unique, making cold spray suitable for depositing well bonded, low porosity, oxide-free coatings. These attributes make cold spray uniquely

suitable for depositing a range of temperature-sensitive materials in this application. The following tool issues can easily be fixed with SST cold spray technology:

Machining errors – Quite often, there can be irreparable errors in the machining operation that render the tool useless. In these cases, it is possible to cold spray an equivalent material to dimensionally restore functionality and then re-machine to proper tolerance (Fig. 4).

Wear and/or snap-offs – Wear and/or snap-offs are another potential issue that can be easily repaired by SST cold spray technology: Simply fill in by cold spray with the appropriate material, then re-machine back to tolerance (Fig. 5).

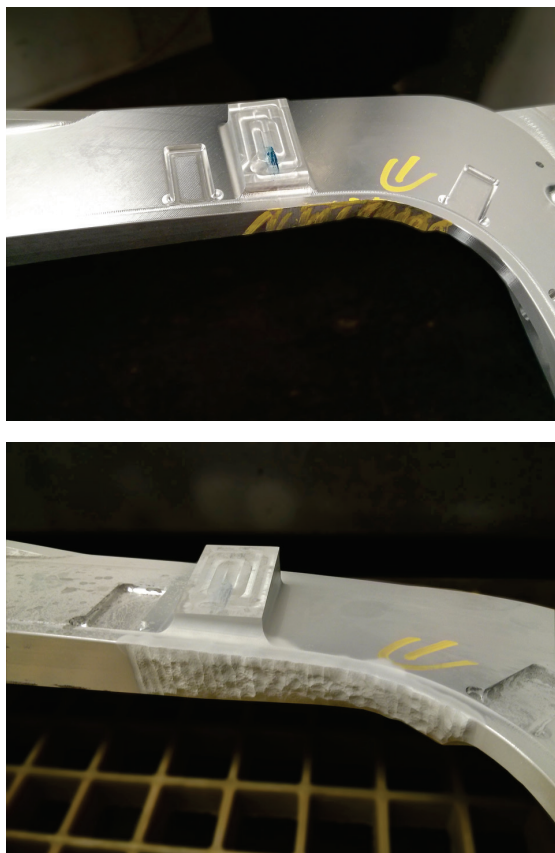


Fig. 4 — Machining errors dimensionally repaired with SST cold spray, before (top) and after (bottom).



Fig. 5 — Snap-off defect dimensionally repaired with SST cold spray, before (top) and after (bottom).

A local manufacturer of high-precision aluminum gauging fixtures saved thousands of dollars by using the SST cold spray technology to salvage a number of high-value fixtures that were either incorrectly machined or simply worn beyond their useful life. ~iTSSe

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