Harolton Alexander and Dave Breuer | Curtiss-Wright Surface Technologies

Shot Peening and Thermal Spray Coatings: Complementary Surface Treatments

Curtiss-Wright Surface Technologies (CWST) is a subsidiary of Curtiss-Wright (NYSE: CW). CWST performs surface treatments and technical services to high-performance OEM parts and their Tier 1 and Tier 2 suppliers. The footprint of CWST consists of 65 job shops located in 16 countries including 40 shot peening locations. CWST offerings to industry are as follows.

- Shot and Laser Peening
- Peen Forming and Distortion Correction
- Super Finishing and Non-Destructive Testing
- Solid Film Lubricant and Liquid Coatings
- Thermal Spray Coatings
- Parylene Conformal Coatings
- Material Testing Services

This breadth of surface treatments provides solutions for a number of component failures including metal fatigue (shot/laser peening), friction and lubrication (solid film lubricants) and corrosion and erosive wear (thermal spray coatings). A full listing of material testing services is available at www.cwst.com/analytical-services.

CWST's thermal coatings group grew as a series of acquisitions in the United States and Europe with seven locations currently providing thermal coatings. Shot peening and thermal spray coatings are the most complementary surface treatments CWST offers.

CWST's Thermal Spray group offers coatings solutions for the following industries:

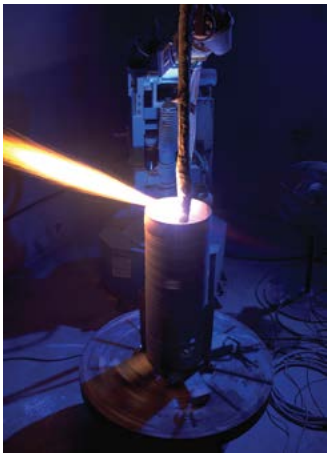
- Aerospace / Industrial Gas Turbine
- Oil and gas / Petrochemical
- Refining / Mining
- Agricultural and On / Off Highway

Thermal spray coatings provide solutions for applications in a multitude of stationary, rotating and linear movement applications. Thermal coatings provide corrosion, wear, erosion, oxidation protection and thermal sealing management.

Aerospace engine applications include hot and cold section components such as vanes, combustion liners, turbine shrouds, casings, knife edge seals, blades, and complex geometry blisks. Dimensional restoration of rotating journals and electrical run-out journals can also be accomplished by thermal spray coatings.

Arc Spraying on ID of Large Housing

Common Thermal Spray Processes



Plasma Spraying on ID of Combustion Liner

HVOF: The high velocity oxygen fuel (HVOF) technique combines a hydrocarbon fuel (in gas or liquid form) and oxygen which is fed into the combustion chamber of the gun. This combination is ignited and forms a high-pressure ultrasonic velocity flame which is accelerated in a similar way as a rocket engine. This propels the molten (or semi-molten) coating material onto the component creating a low-porosity and high-tensile strength coating.

Flame Spray: Flame spraying is a coating process that uses the heat of combustion. The flame produces heat which melts the thermal spray material. Molten particles are then propelled onto the surface to be sprayed. When using powder flame spray, metal or ceramic powder particles are softened and

melted by the flame. Then, they are sprayed onto the surface to be coated by the use of the combustion gases through a nozzle.

Plasma Spray: Plasma spray uses extremely high temperatures of a plasma plume which is generated by electrically ionizing a controlled gas stream. This allows high melting point materials such as refractory metals and ceramics to be applied. Lower melting point materials such as abradables containing polymers, metallic materials, and carbide cermets can also be used. Plasma spray coatings can be optimized for controlled levels of porosity making this process the ideal choice as a thermal barrier coating for critical applications operating in severe high-temperature environments.

Shot peening can be specified before or after thermal spray coatings depending on the application.

When is shot peening performed *before* thermal coating?
Many high-performance components require the benefits of both shot peening and thermal spray coatings. In these situations, shot peening is performed before thermal spray. Shot peening provides a layer of high magnitude (residual) compressive stress that opposes the initiation of surface cracking.

Most thermal processes are discouraged after peening as they may relieve the shot peening stress. When applying thermal coatings, either the component or gun is in motion such that the dwell time of the thermal coating application is short. This minimizes relaxation of shot peening compressive stress and corresponding benefits.

When is shot peening performed *after* thermal coating?
Shot peening compressive stress is beneficial in removing potential detrimental residual stress that occurs during the coating process. In addition, many real world applications involve contact with other surfaces where wear is an important consideration. Thermal-coated surfaces without subsequent treatment generally have rough surface finishes due to inherent porosity.

Shot peening after thermal spray offers benefits associated with reducing wear. Increases of surface hardness up to 25% offer more wear resistance. This is accomplished by densifying the surface via shot peening cold work and reducing surface porosity. In addition, an improvement in surface finish from peening is achieved thus lowering the coefficient of friction. Greater surface harness and improved surface finish usually offer better wear resistance for most applications.

Additional information on Curtiss-Wright Surface Technologies and our shot peening and thermal coatings can be found at www.cwst.com.