

THERMAL SPRAY COATING PROCESSES

Thermal spray is a generic term used for a coating process in which the coating material is heated or melted quickly by means of combustion, electric arc or plasma, and simultaneously projected by gases onto a prepared substrate.

Thermal Spray Coating Processes and Diffusion Alloys

The HVOF (High Velocity Oxygen Fuel) process involves the combination of either a liquid fuel or gas with oxygen in a combustion chamber. A controlled and balanced measure of powder material is injected into the enclosed flame, which is then projected at high velocity onto the prepared spray surface. Diffusion Alloys was an early mover in the application of HVOF coatings for the European gas turbine industry, first qualifying its process for coating turbine blades and vanes in 2005. We are currently expanding our capabilities into Air Plasma Spray – Thermal Barrier Coatings.

Properties and Uses of HVOF coatings

As a Line of Sight process, HVOF is used for the application of MCrAlY coatings and hard face materials such as Tungsten Carbide and Chromium Carbide coatings that are used in a wide range of industries, including gas turbine manufacture and oil & gas.

MCrAlYs are used in the gas turbine industry as standalone protective coatings and as bond coatings in a thermal barrier protective coating systems.

Hard face coatings such as Chromium Carbide and Tungsten Carbide are applied to improve wear resistance, thereby improving component service life and reliability. Chromium carbide is a ceramic compound that exists in several different chemical compositions; Cr₃C₂, Cr₇C₃, and Cr₂₃C₆. At standard conditions it exists as a gray solid. It is extremely hard and corrosion resistant. It is also a refractory compound, which

means that it retains its strength at high temperatures as well. These properties make it useful as an additive to metal alloys. When chromium carbide crystals are integrated into the surface of a metal it improves the wear resistance and corrosion resistance of the metal, and maintains these properties at elevated temperatures. The hardest and most commonly used composition for this purpose is Cr₃C₂. The Chrome Carbide is deposited with a matrix of Nickel/Chrome to locate and maintain the Cr₃C₂. This coating exhibits good hot gas and corrosion resistance.

Tungsten carbide (WC) has equal parts of tungsten and carbon atoms. It is extremely strong and wear-resistant, there being only a few materials on earth that can be used to cut or engrave it, with industrial diamond abrasives being one of these. As a coating the Tungsten Carbide is normally deposited as particles in a Cobalt matrix. The dense coating has excellent low temperature wear properties.

In comparison to other mainstream coating spray processes, the thermal and high kinetic energy imparted to the spray powder results in:

- a dense coating
- excellent bond strength
- low oxide content
- good as sprayed surface finish

Diffusion Alloys' Thermal Spray Facilities and Processes

Diffusion Alloys' unique HVOF spray cell, with a custom built robotic system, allows us to repeatedly and efficiently provide

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our customers with high quality HVOF coatings. We have a Swiss-manufactured HVOF coating unit with an MP100 control system integrating a two-axis turntable, a six-axis ABB IRB 2400/16 robot and a K2 kerosene spray gun. The modular design of this unit allows it to be upgraded to additionally apply air plasma sprayed thermal barrier coatings.

The Company also has a UK manufactured wire arc spray unit which is used to apply aluminium sealing strips to the dovetail of industrial gas turbine blades. This operation is robotically controlled. A proprietary masking technique is utilised.

Summary

With our unique blend of thermal spray coating capabilities, supporting processes and experienced technical team, Diffusion Alloys welcomes the opportunity to discuss specific applications to resolve our customer coating requirements.

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