

COATING PROCESS

High-Velocity Oxygen-Fuel thermal spray system (HVOF)

HVOF is a technique used to apply a metallic or composite metal/ceramic coating. It is based on the use of a gas flow with high temperature (over 2000°C) and high speed (over 2000m/s) to project molten particles on a target surface.

The system is composed by a spray-gun, containing a combustion chamber and expansion nozzles responsible for the combustion reaction and acceleration of the gas flow, that is mounted on a robot that moves the gun along the target component at precise distance and speed. These are enclosed in a soundproof spraying booth, with some ancillary devices that provide process gases, electric power, cooling air and water, and feedstock powder.

Coatings obtained with this technology are optimized for wear resistance, often in combination with corrosion-resistant material formulations that allows use in harsh environmental conditions and extreme stressing applications. Hard-facing metallic alloys as Stellites, or composite systems of carbides in metallic matrix, as WC-Co or Cr₃C₂-NiCr are commonly used compositions. Given high density and low flight time of particles, it is also possible to obtain metallic coatings with low oxidation for corrosion resistance at low and high temperatures, based on Inconel, Me-CrAlY alloys, stainless steels, copper-alloys, and other. Typical thickness range for these coatings is 10µm up to over 1mm.

Industrial application of HVOF ranges from wear resistant components in manufacturing (glass-mould plungers, steel mill guides and rolls), heavy equipment (hydraulic rods and pistons), petrochemical (valve assemblies and pump components), aviation (compressor and turbine blade coating, landing gears, actuators, flaps), power generation (industrial gas turbines and hydroelectric turbine coating, nozzles).

Our system is designed for research purpose, with a 2-axis manipulator combined to a rotating headstock with horizontal axis, suitable for coating plane samples and cylinders, and could be used for manufacturing of small batches. A coating designed and realized with this equipment is easily scalable on industrial production, since industrialization relies in a simple upgrade in manipulation of workpiece and spray gun.

Thermal spraying plant features

HVOF System Oerlicon Metco:

Spray gun HVOF DJ-M	Fuel gas: Hydrogen-fed Water/Air-cooled Diamond Jet Gun
Control unit DJCE-H	Gas speed: 2140 m/s (water-cooled) - 1373 m/s (air-cooled);
Handling controller DJCE-2600	Gas temperature: 2600-3000 °C; Total heat output of 113 kW (water and air-cooled);
Powder feeder 9MPE-DJ	Gravimetric powder feed operation system; Closed-loop feed rate monitoring and control system; Hopper capacity of 5.5 liters; Rotameter flow carrier gas metering; Feed rate: 5-300 g/min Particle size: 2-200 µm

Manipulator and handler - Ticienne:

Gun handler with X-Z translation translation	PLC controlled cartesian manipulator; X axis: 1100 mm travel and 0-200 mm/s speed Z axis: 500 mm travel and 0-120 mm/s speed Manual regulation of spray distance
Workpiece headstock with horizontal axis	Horizontal axis rotating headstock with Manually operated tailstock Rotation speed: 0-300 RPM Supported weight: 150 Kg max. (with tailstock) Ø = 500 mm max., L = 900 mm max.

Soundproof booth

SITA Impianti	400x300x250 H cm
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Air filter and dust collector

Donaldson Torit DFO3-18-R	Residual emission ≤ 2 mg/m ³ Processed air 10.000 m ³ /h
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