

Why High Velocity **Air** Fuel (HVOF)



M4 HVOF Spray System



US Thermal Spray LLC has chosen the HVOF thermal spray system (Uniquecoat Technologies LLC) because this technology applies the highest quality cemented carbide coatings.

Wear resistant coatings containing a high percentage WC (80-90%) cannot be applied by traditional welding procedures. There is insufficient matrix (Cobalt or Nickel) to wet-in during welding to metallurgically bond to the substrate. Such a high carbide content material, in the form of a fine powder (2-5 micron), requires a high velocity spray system for application. Essentially, the WC particles impact the substrate at supersonic speeds which creates a strong, dense mechanical bond.

Historically, these coatings have been applied using a High Velocity Oxygen Fuel (HVOF) thermal spray system. A mixture of pure oxygen and fuel (kerosene) ignites in the combustion chamber creating a high velocity jet. Powder is accelerated by this exhaust jet and impacts the substrate. A downside of using pure oxygen as accelerant is the high temperature (2900° C) and the potential to decarburize the powder. WC is converted (high temp + O₂) to W₂C which is hard, yet brittle and tends to fracture. Additionally, elevated temperatures can vaporize the matrix metals reducing their ability to bond powder particles.

The HVOF process uses compressed air (+/-21% Oxygen) and propane. This combustion temperature is 1000° C lower than HVOF while velocity is 200-400 m/sec higher. Lower temperature, less oxygen and higher velocity results in a tougher, less brittle and more wear resistant coating.

Spray Method	Combustion Temp °C	Particle Vel (m/sec)	Adhesion (PSI)	Oxide content (%)	Porosity	Spray rate (Kg/h)	Typical Thick (mm)
HVOF	2950	500-800	>10,000	1-5	1-2	2-8	0.1-2
HVOF	1900	600-1200	>10,000	= feedstock	0-0.2	2-30	0.1-12

The main benefits in HVOF are:

- Lower flame temperature vs. HVOF
- Higher retention of carbides producing excellent coating properties
- High powder feed rates for high production rates