

## Wear and Corrosion Resistant HVOF Coatings For Small Internal Diameters of Pipe Lines and Industrial Equipment

**High Velocity Air-Fuel Spraying (HVOF)** is an advanced method for deposition of the highest quality carbide and metallic alloy coatings, which are used for protection of industrial equipment against severe wear and/or corrosion.

In the process the powdered coating material, such as cemented tungsten carbide or a metallic alloy, is supplied to the HVOF gun. The gun combusts the air and propane mixture in the internal combustion chamber and expends the products of combustion through the profiled nozzle in a form of a supersonic velocity jet, working as a small rocket engine. The supplied powder is heated in the combustion chamber and accelerated in the nozzle faster than sonic velocity. When the powder particles impact the substrate they form dense and high-strength coating.

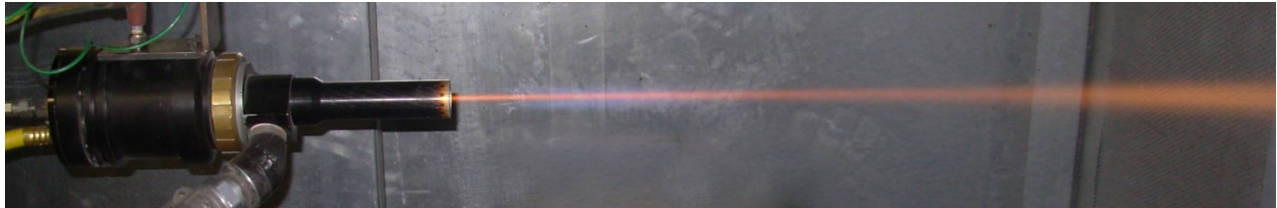
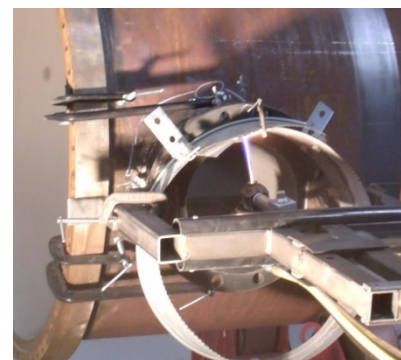
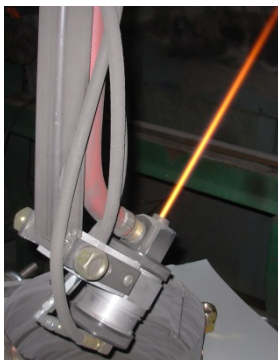


Fig.1. The AK-07 HVOF Gun is “a small rocket engine”, generating a jet of metal particles with a velocity over 1000 m/sec. Such particles form extremely dense and tough coatings. Our “signature” coatings are tungsten carbide coatings (WC-12Co, WC-10Co-4Cr, etc.) which are non-permeable to gas and have hardness 1400-1600 HV<sub>300</sub>. In spite of high hardness, these coatings are not brittle since decarburization or oxidation does not occur in comparably low-temperature HVOF process.

Kermetico Inc. has been developing and manufacturing such guns and HVOF spray equipment since 2006. The company is actively involved in the coating services business, spraying the parts as small as a fraction of an inch and as large as 20,000 lbs. hydro-turbine rotors and 6-foot diameter x 25-ft long oil refinery vessels in its spray shops, located in the Benicia Industrial Park, CA.

Communicating with our customers, we understood the needs for wear and corrosion resistant coatings in hard-to-reach, line-of site areas like pump and cyclone housings, nozzles, barrels and small diameter pipe components- spools, elbows, crosses, etc. In 2011 we created a smaller size gun, AK-05-ID for spraying tungsten carbide coatings inside pump housings and cyclones with ID 9 inches or larger as well as Hastelloy C coatings inside the vessel nozzles.

Fig.2. The AK-05-ID is our first HVOF gun for deposition of coatings inside diameters 9 inches



### Coating inside small diameters

Extensive development in 2012 resulted in creation of AK-04-ID HVOF gun, capable for deposition of tungsten carbide coating inside internal diameters as small as 3.5 inches. New ideas were successfully implemented in this gun. With only 30 kW equivalent power the gun sprays 5-6 kg of tungsten carbide per hour, reaching hardness of 950 HV300 in 3.75-4.0-inch internal diameters and over 1200 HV300 hardness in 4.5-5.0 inch internal diameter.

Fig.3. AK-04-ID is the smallest high velocity spray gun in the world, capable of depositing quality coatings inside 3.5-inch internal diameter

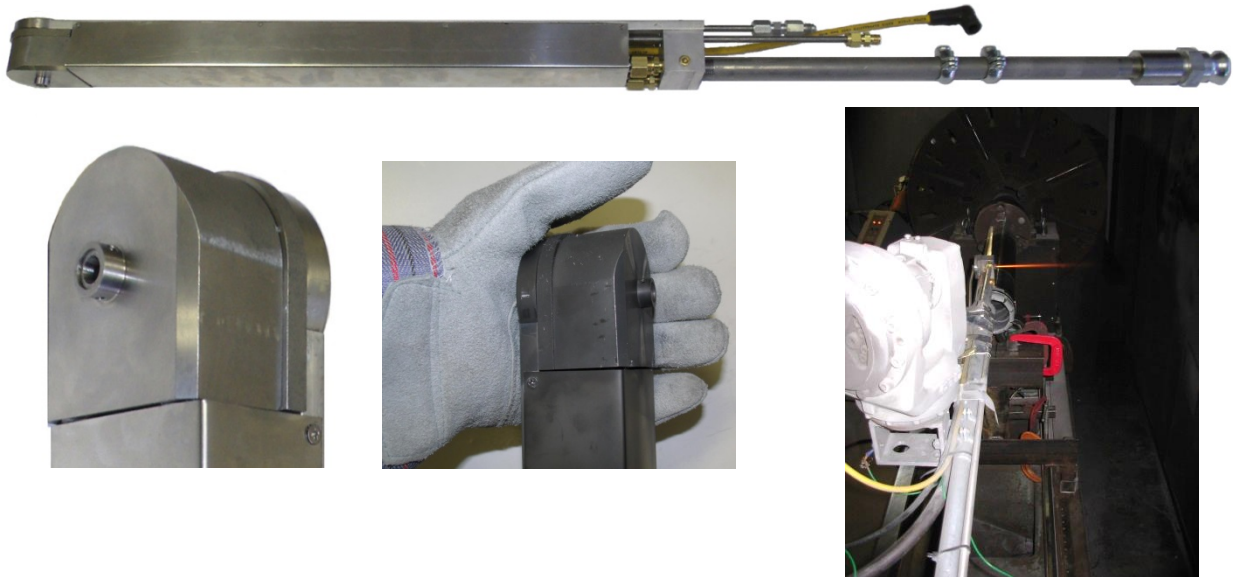
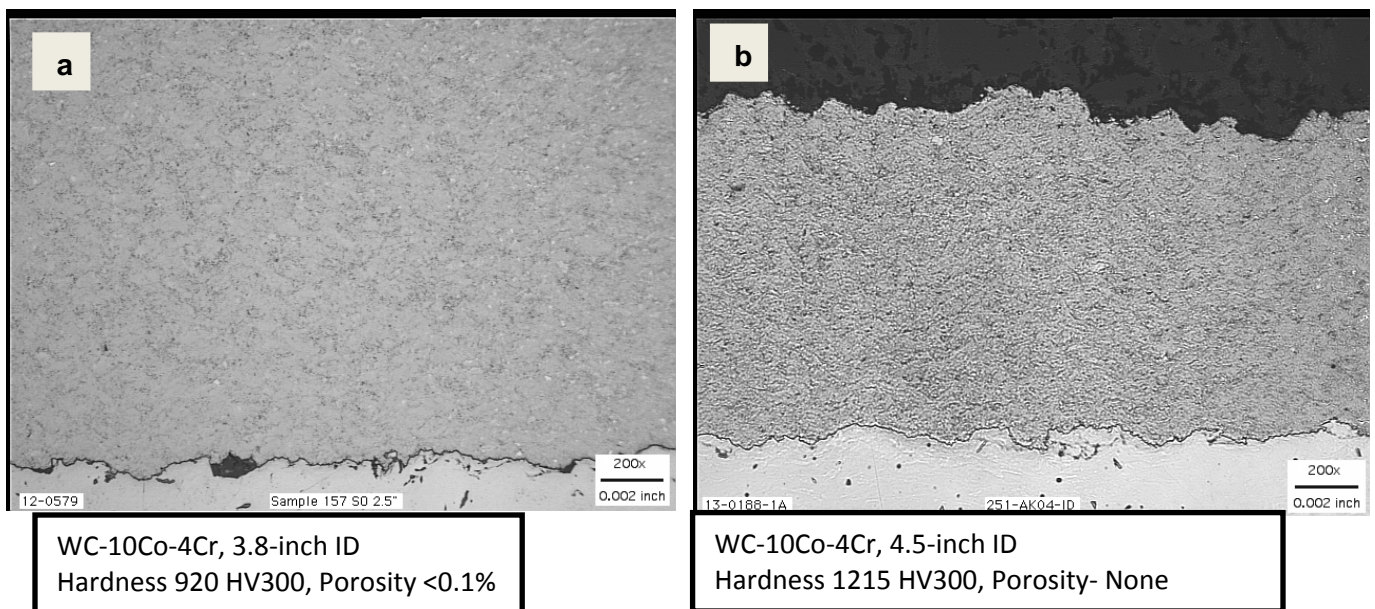
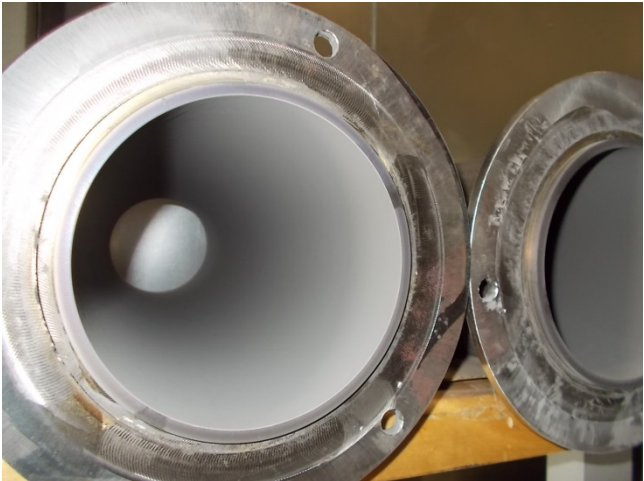
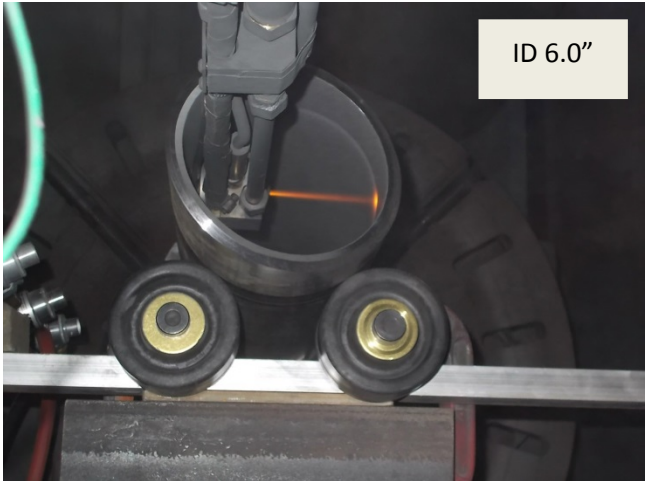
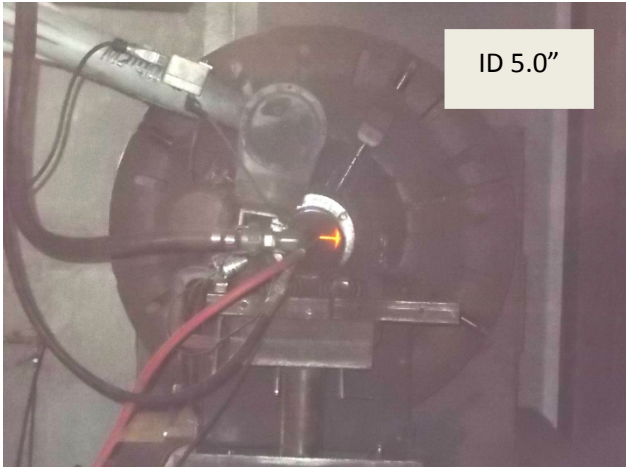
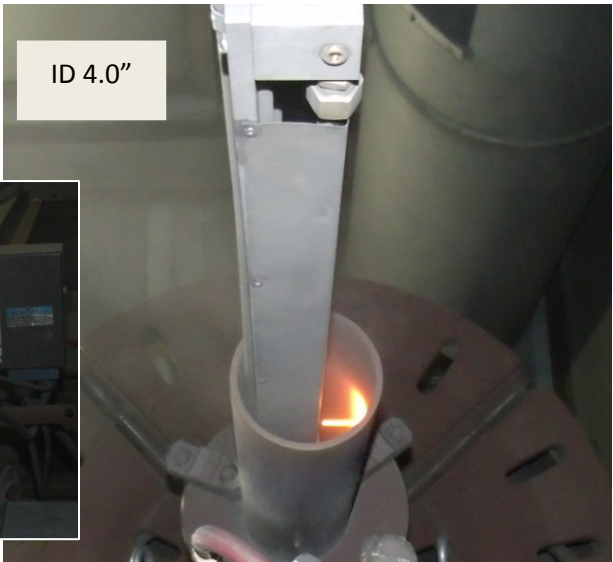
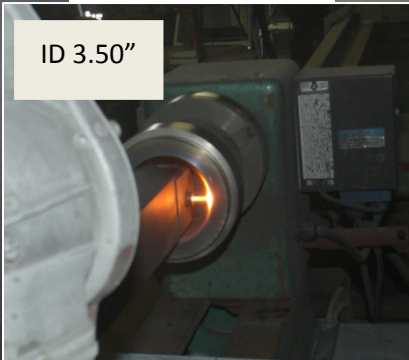
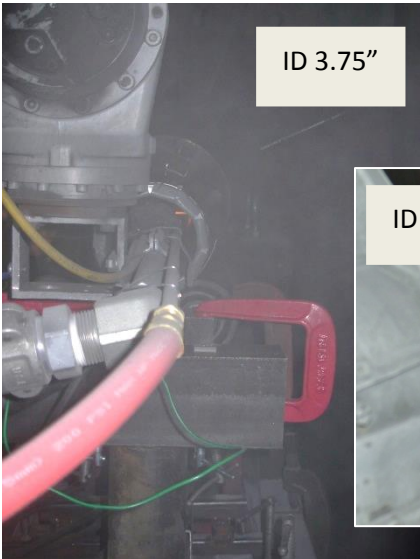


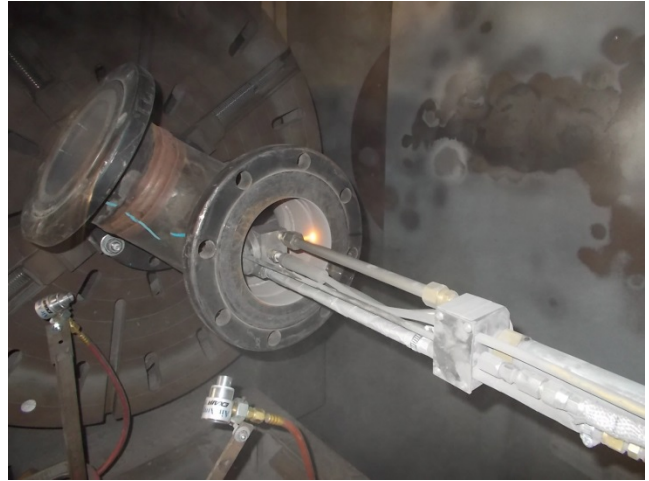
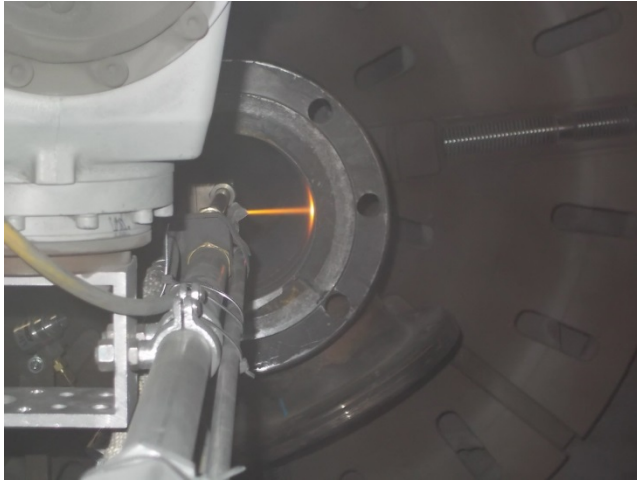
Fig.4. Micrographs of tungsten carbide (WC-10Co-4Cr) coatings sprayed with AK-04-ID gun in 4.5" ID barrel: particle velocity 650 m/s (a) and 920 m/s (b)



Applications of coatings with AK-04-ID HVOF: Barrels and Sleeves



**Applications of coatings with AK-04-ID HVOF: 6-inch ID Coke Transport Pipe**



**Contact information:**

Kermetico Inc.  
3900 Oregon Street, Suite 2, Benicia, CA 94510  
Phone: (707) 745-3862. Fax: (707) 745-3894  
Website: [www.Kermetico.com](http://www.Kermetico.com)