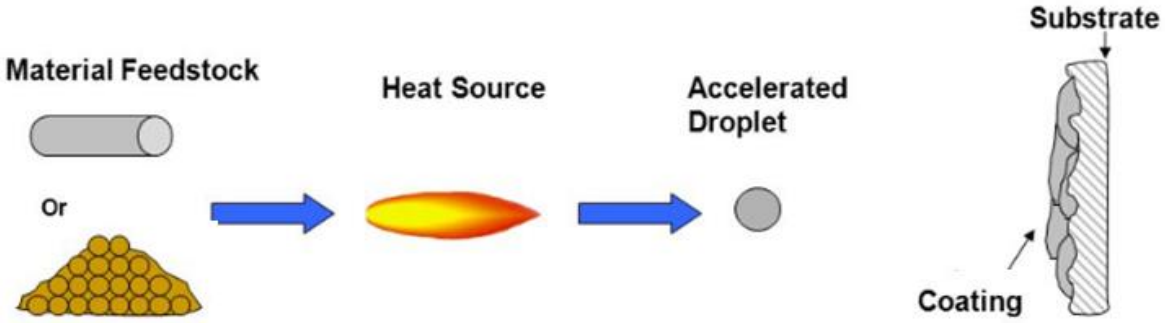
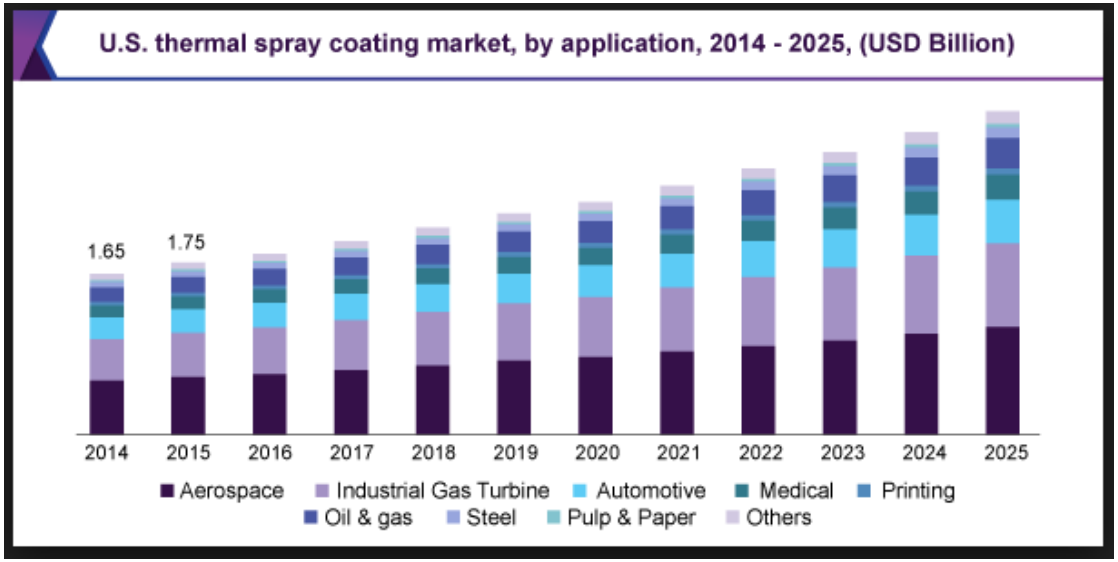
What is Thermal Spray?

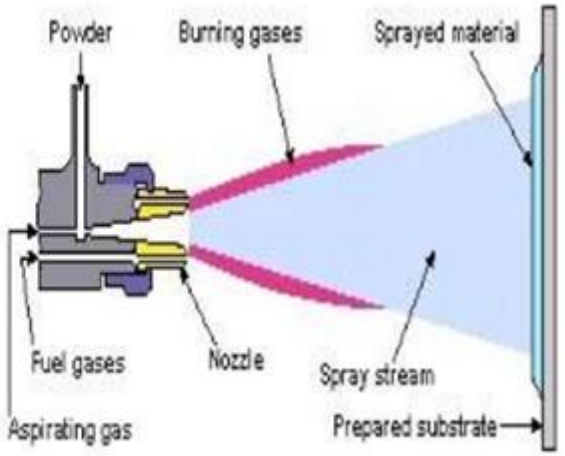
- Thermal spray is NOT a welding process
- Thermal spray coatings are a melted, or softened ceramic, metallic, or polymer materials are transported by a gas stream to a properly prepared substrate

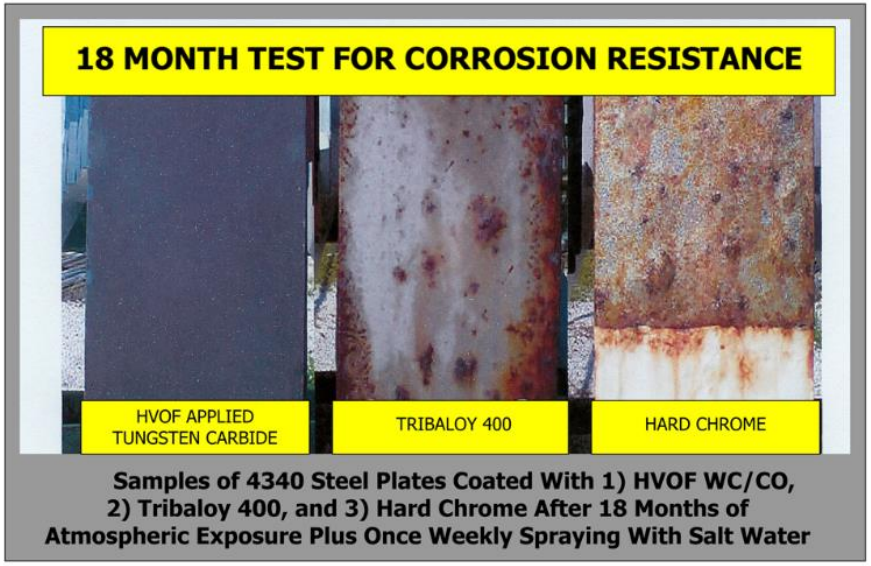




THERMAL SPRAYING

- Thermal spraying is one of the most versatile techniques available for the application of protective coatings.
- Flame spraying is the simplest method which has two forms of consumables available for use – wire and powder.

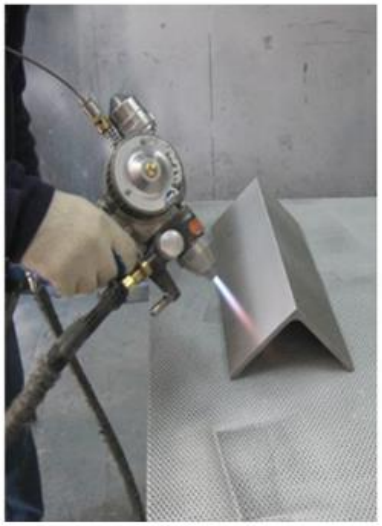




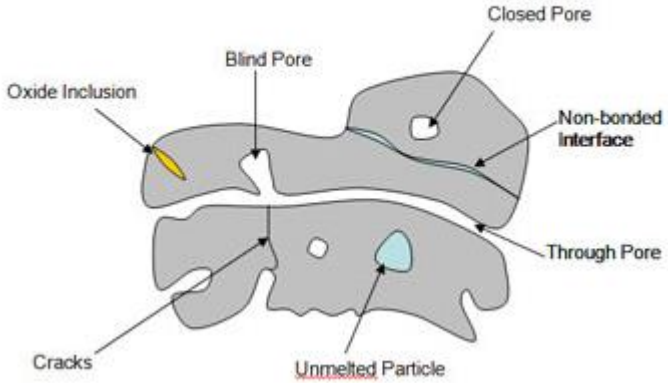
Samples of 4340 Steel Plates Coated With 1) HVOF WC/CO, 2) Tribaloy 400, and 3) Hard Chrome After 18 Months of Atmospheric Exposure Plus Once Weekly Spraying With Salt Water

Flame spray

- Single wire fed into spray gun
- Acetylene/oxygen flame melts wire
- Compressed air blows melted metal onto surface

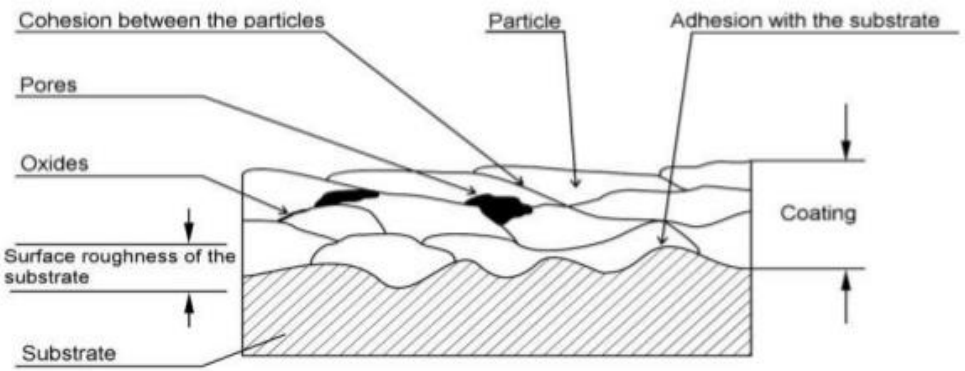


Porosity Forms

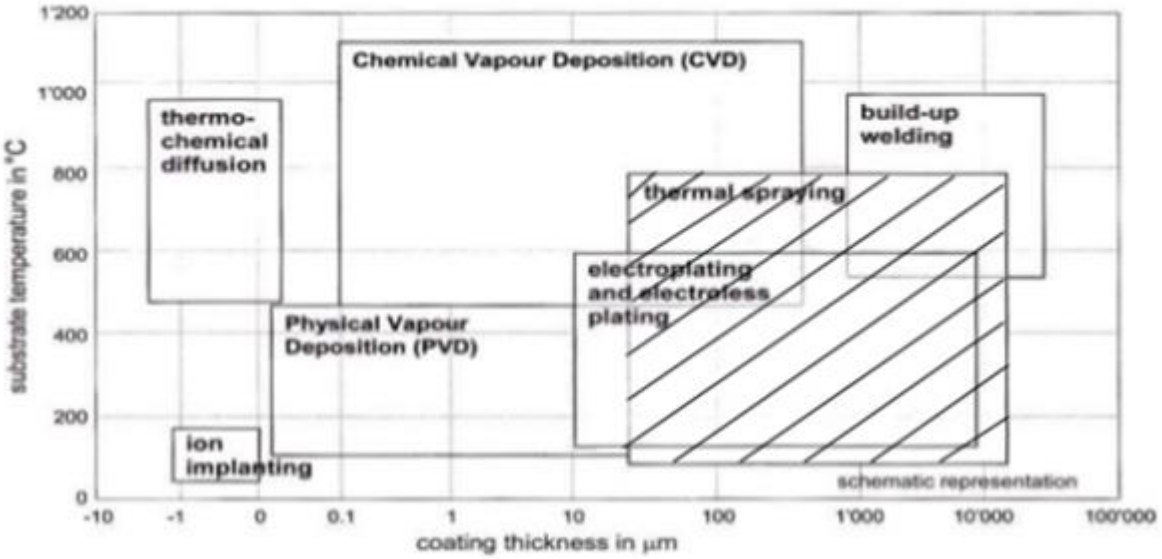


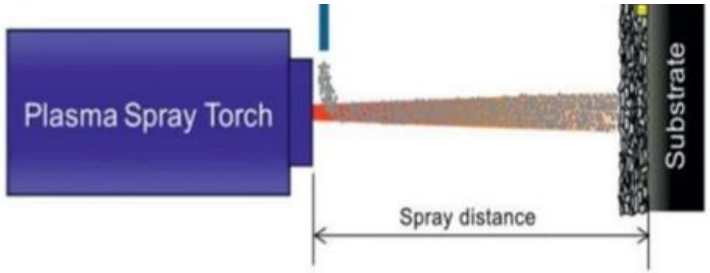
Sprayed coating's structure

Typical structure of a coating



Comparison of the coating processes

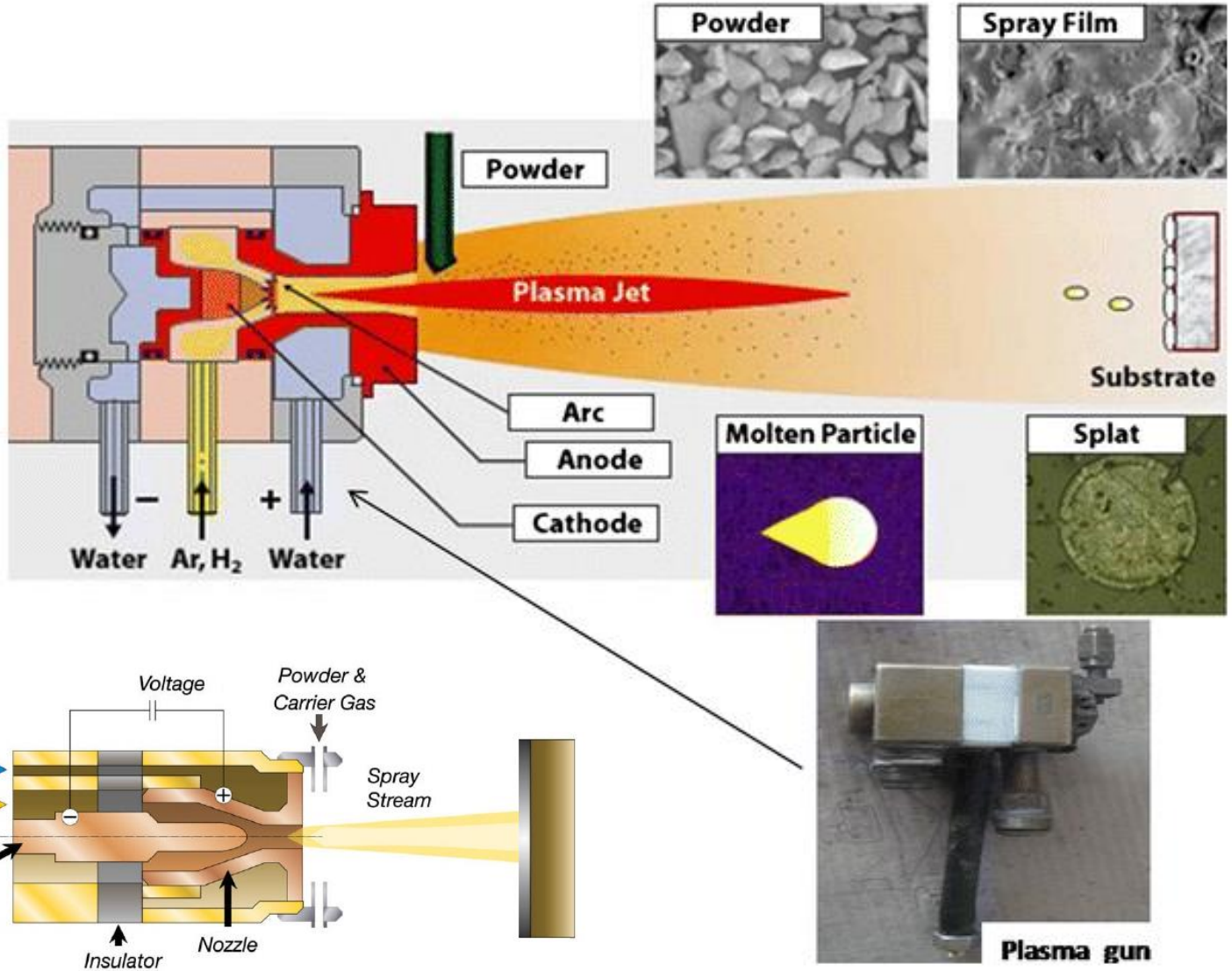




In plasma spraying process, the material to be deposited (feedstock) is introduced into the plasma jet, emanating from a plasma torch.

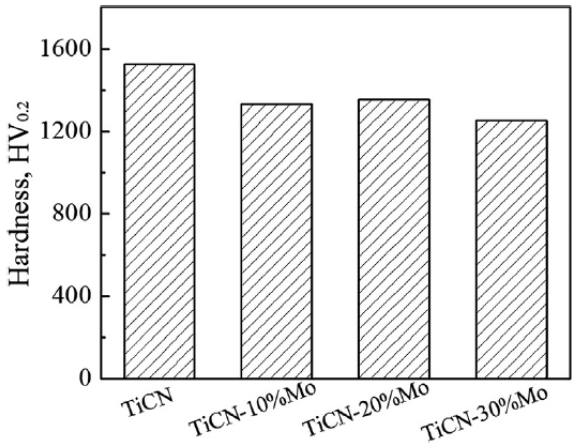
In the jet, where the temperature is of the order of 10,000 K, the material is melted and propelled towards a substrate.

There, the molten droplets flatten, rapidly solidify and form a deposit.


Powder
Spray Film
Powder
Plasma Jet
Substrate
Arc
Anode
Cathode
Molten Particle
Splat
Water
Ar, H2
Water
Voltage
Powder &
Carrier Gas
Cooling
Water
Plasma
Gas
Electrode
Spray
Stream
Insulator
Nozzle
Plasma gun

Microstructure and tribological properties of plasma sprayed TiCN-Mo based composite coatings

TiCN coatings can be produced by using several techniques including magnetron sputtering [24,25], arc ion deposition [26,27] and chemical vapor deposition. Nevertheless, these methods usually produce thin TiCN films. Owing to the simple deposition condition, high deposition rate and enhanced cohesion strength, reactive plasma spraying (RPS) is most suitable to produce thick TiCN based coatings with high performance [28,29]. In our previous study, nanostructured TiCN coatings ($TiC_{0.2}N_{0.8}$) are successfully fabricated by using RPS with Ti feedstock under the mixed gas condition (N_2-C_2H_2) [30]. Recently, nanostructured TiCN coatings with high C content phase ($TiC_{0.7}N_{0.3}$) are also obtained by using RPS technique with Ti-graphite aggregates under N_2 condition [31,32]. It is reported that the addition of Cr is lead to enhancing the mechanical properties of plasma sprayed TiCN coatings [33]. Since Mo shows better wettability and strength than Cr, the addition of Mo in plasma sprayed TiCN coatings is expected to have enhanced mechanical properties.



Surface hardness of the TiCN coatings with different Mo additions.