HISTORY

EARLY STAGES

Thermal spraying is dated back to a method patented by Oerlikon in 1882 which involved spraying lead powders against a fixed surface. The process was developed to make lead plates for batteries. Although lead was the material used for early coatings the process was refined and more patents followed.

Thermal spraying got its boost, from the work of Max Ulrich Schoop, Switzerland who is considered as the "Father" of thermal spraying. Schoop and his associates developed equipment and techniques for producing coatings using molten and powder metals.

In 1909, he patented the first commercially viable thermal spray plant for delivering metal coatings.

In 1912, he developed the first practical flame spray wire gun, also known as the 'pistol' back then.

In 1914, Max Schoop patented a twin wire arc spray gun. He continued his research into materials and methods of thermal spraying, including plasma spraying.

THE INCEPTION

The thermal spraying technology was then adopted in Germany for several applications and brought into USA in the 1920s and 30s by Richard Binder with the formation of Metal Coatings co. The technology continued to be introduced to various applications in the 1930s.

Some of the applications were: lead coatings for dental light bulbs, copper coatings on clamps for power line, lamp posts were coated with bronze, auto / airplane manifolds were protected against corrosion with Al, hydro-turbines were reclaimed from cavitation damage by spraying and grinding steel and wide range of rods/shafts/rams/brake drums were given new life by metallizing.

The principle thermal sprays process during the early years of 1920s-1950s was wire and powder flame spray. The key driver in the early years was materials reclamation, particularly large industrial machinery and cathodic corrosion protection of very large steel structures. In the former situation, a number of automotive components including crankshafts, clutch plates, exhaust valves were coated both at the stage of original equipment manufacturing and remanufacturing. Even automotive cylinders made of Al alloys

were thermal sprayed for wear protection. Field applied coatings of Al and Zn were used for protection of large barges, chemical process tanks, bridge structures and water storage tanks.

The 1930s saw the evolution of Metallizing engineering company, which subsequently became Metco. Major innovations occurred in both process engineering and applications. Notable among them were spray and fuse processes to ensure good metallurgical bond between sprayed material and substrate as well as the development of rod flame spray processes for the deposition of ceramic oxides.

The 1950s saw the emergence of DC plasma spray towards application of refractory materials, notably ceramic oxides. It involved the latent heat of ionized inert gas (plasma) being used to create the heat source. The most common gas used to create the plasma is argon; also, referred to as the primary gas.

THE FIRST STEPS

Upon perusal of early documents and associated analysis suggest that most of the early applications were created bottom-up. That is, believers of thermal spray technology pushed applications upstream by demonstrating the value proposition of surface engineering. Corrosion and material reclamation were the primary drivers. A key demonstration of the material reclamation was in the paper industry. These engineering components are generally large in size and as such the value proposition of surface engineering for both protection and reclamation were very strong.

In 1960, Scott Paper Company, conducted on-site application of flame sprayed stainless steel coatings onto a tissue producing Yankee dryer. The application was perhaps unplanned as it was driven by production needs and avoidance of system down time. This initial application led to many more opportunities for in the paper industry.

As the spray technologies become more sophisticated so did the opening up of opportunities. However, the first step towards integration of coatings in system design came from the aerospace industry, most notably Pratt and Whitney Aircraft in US. Two parallel opportunities arose: Defense and missile programs of 1950s and 60s developed a need for sprayed ceramic coatings for thermal insulation applications, while commercial aviation industry pushed the envelope in terms of operational limits of metals resulting in need for coatings and surface engineering technologies.

The convergence of these developments led to integration of thermal spray as a process of choice in the 1970s and 1980s for component protection and performance enhancement in the aero-engine industry.

It was in the early 1980s that Browning and Witfield, using rocket engine technologies, developed a new way of spraying metal powders. It was referred to as High Velocity Oxy-Fuel (HVOF). The powder partially melts

in the stream, and deposits upon the substrate. The resulting coating has low porosity and high bond strength.

The successful adoption of thermal spray by aero-engine perhaps represents the first major integration of coatings within the design cycle. From wear coatings to thermal barriers to abradable seals, thermal spray coatings had to meet exacting requirements in terms of performance, reliability and safety. This development led to a spill-off effect into other sectors through market confidence in the technology. Many new industries contemplated thermal spray industry including land-based turbines, steel mill components, earth moving machinery and even biomedical implants. We are thus, living of this amazing legacy even today.