

Coatings Continue to Combat Age Old Enemies

By Kelly Schoof

Since the dawn of humankind people have been searching for inexpensive methods of giving design components extraordinary properties; to this end coatings have been employed. Even the very first boats made consisted of wood and tree bark overlaid with pitch to stop moisture absorption that caused water logging and wood rot. Today, many design components for an aircraft, ship, or piece of drilling equipment constructed entirely of one material type will not have all the properties needed at reasonable cost. The secret to giving an ordinary part extraordinary surface properties is through the implementation of a coating. Coatings have progressed from tree pitch to metallic plating and thermally sprayed ceramics.

Rapid Industrial Growth Creates Demand for Hard Chrome

In the early part of the 20th century, hard chrome plating started to become a viable coating method for protecting steels from corrosion and abrasive wear. By the early 1960's, the market for such coatings had grown sufficiently that it was viable for an Edmonton company, Western Hard Chrome (WHC), to incorporate servicing this need. Although hard chrome was how the company started, the process line did not stay limited to just chrome; several other plating processes lines such as zinc, cadmium, and nickel were implemented.

Western Hard Chrome's involvement with chrome plating is strictly industrial, meaning they don't process decorative plating for such things as bumpers. Hard chrome plating is typically used in situations where parts are in contact with corrosive solutions and/or abrasive wear. Seal fits for turbines, pump shafts, sizing grates and valve balls are among just a few parts to commonly employ hard chrome coatings. Even aircraft engine cylinder jugs have been hard chrome plated to extend their life and offer better performance through better lubrication. Yes, that's right, in addition to polished hard chrome's naturally low coefficient of friction, there is yet another generally unknown property of hard chrome that makes it stand out – microcracks. When examined with a high power microscope hard chrome plating will reveal a network of fine cracks. Although most people identify cracks with something that's falling apart, these cracks are very important in many applications such as the aircraft cylinder where the cracks hold engine lubricants at the microscopic level, providing better cylinder and ring wear properties.

Electroless Nickel Plating Produces Superb Corrosion Resistance and Surface Profile Retention

Although hard chrome plating is superb in many applications it does have some limitations in high saline or sulfuric acid conditions, that's where WHC's diversity comes into play. In such condition, an electroless nickel coating would most likely be the coating of choice. Electroless nickel (or ENC) provides a corrosion resistant overlay for a wide variety of galvanic and high temperature corrosion applications while possessing the ability to uniformly plate complicated, complex shapes. This would be impossible to do with hard chrome plating since hard chroming (as is most plating) an electrolytic process involved with forced current flow through the plating

solution. ENC is a chemical reaction that can occur in areas where ionic plating currents would be blocked by the electrical shielding of the part itself. ENC also has the ability to plate onto a surface with a given surface profile and render the same profile after plating. This means that if the surface to be plated was originally polished, the plated surface would retain the same smooth polished profile.

High Velocity Oxygen Fuel Thermal Spraying Opens a Galaxy of Coating Possibilities

In the mid 1970's WHC took a leap into the new high tech realm of thermal spray. A wide range of thermal spray coatings were new on the scene and Western Hard Chrome was one of the first Edmonton companies to be involved in this new technology. In many situations, a plated surface does not afford the combination of wear and corrosion protection needed, or perhaps the component needs a coating with a higher bond strength than that of traditional plating methods. This is where thermal spray usually takes over the situation. The variety of thermal spray processes is extremely vast and the materials and materials' property variations diversify this field to make the possibilities nearly unlimited.

Western Hard Chrome has a tremendous depth of experience in the areas of HVOF (high velocity oxygen fuel) and spray/fuse thermal spray coatings. HVOF thermal spray is a supersonic process that involves the acceleration of the material to be applied at supersonic speeds before fusion impacting the surface being applied to. This process has the distinct advantage of being able to apply a super wear resistant tungsten carbide rich coating to a part without heating the part beyond 140⁰C. This means, unlike many overlay and hard surface welding processes, the part temperature does not get high enough to change the heat treatment in the part being sprayed. Similarly, WHC's Plasma spray process does not change the structure of the part being sprayed but can apply a ceramic coating that will withstand highly corrosive surroundings.

Spray and Fuse coatings are an example of a thermal spray process that forms a metallurgical coating-substrate bond with an extremely high tensile strength. WHC does a lot work with nickel based chrome carbide and chrome boride alloys via the spray and fuse process. The majority of these coatings are applied for the oil patch; however these coatings are also well suited for the mining industry in such components as shovel teeth, crusher teeth and wear bars.

Plasma Transferred Arc Welding Allows High Overlay Thickness with Minimal Substrate Dilution

Western Hard Chrome is not only a leader in the areas of thermal spray but also in advanced welding processes. One process that stands out is the PTA, meaning for Plasma Transferred Arc. The PTA process is another example of a process that is able to apply a wide range of materials for a wide range of applications. The ability of a PTA coating to have a minimal amount of substrate dilution with an overly thickness of up to 3/16 of an inch thick is very workable. The coating selection available range from Stellite #6 which WHC uses to apply to seat faces of large cruise ship engine valves to cobalt tungsten carbide that works well on mine rock crusher teeth and bucket/shovel teeth.

Quality Work is Paramount

Western Hard Chrome's General Manager, Ron Mueller says, "The entire basis of what WHC does is rooted in the profound belief that everybody can win. This means the customer wins because his parts last longer per dollar spent, WHC wins because we employ highly skilled people to perform the processes necessary to complete a job", says Ron. Furthermore, many proprietary techniques have been developed at WHC that has furthered their capability above and beyond the level most chrome and thermal spray companies achieve. As Ron put it, "Our products and work ethic must be geared toward excellence, efficiency and customer satisfaction. We work for the customer, as long as it takes and as much as it takes."

Often customers will come with a corrosion or wear problem that they aren't sure how to handle. Western Hard Chrome's Engineering department will attack the situation from several different angles to formulate a solution. Sometimes there is very little experience to draw from, however in this case the best decision is made based on what data is available. A close relationship with the customer is established to test and improve the product.

As we move into the 21st century, industry, whether working from the deepest mines or beyond earth's atmosphere, is demanding longer life equipment with higher production efficiencies. Informed engineers in these industries have already discovered the benefits of utilizing special coatings to further component properties and life. Present trends show increasing demands for specialized coatings to produce more prosperous industries in the future.