Technical Bulletin

HYDE™
Industrial Blade Solutions

Surface Finish Processes for Metals

Plating and coating are surface-finishing processes applied to metals to impart enhanced physical characteristics, such as corrosion resistance, wear resistance, increased hardness and greater work edge durability.

Plating

Plating describes surface-covering where a metal is deposited on a conductive surface. Plating has been done for hundreds of years, but it is also critical for modern technology. Plating is used for corrosion inhibition, to improve solderability, to harden, to improve wearability, to reduce friction, to improve paint adhesion, to alter conductivity, for radiation shielding, for decoration and for other purposes.

- **Zinc Plating -** Zinc coatings prevent oxidation of the protected metal by forming a barrier and by acting as a sacrificial anode if this barrier is damaged. Zinc oxide is a fine white dust that does not cause a breakdown of the substrate's surface integrity as it is formed. Zinc oxide, if undisturbed, can act as a barrier to further oxidation, in a way similar to the protection afforded to aluminum and stainless steels by their oxide layers. The zinc plating process is the most economical for applications exposed to atmospheric corrosion.

- **Electoless Nickel Plating -** Electroless nickel (EN) plating is a process where a coating of nickel is deposited on a substrate. Unlike electroplating, it is not necessary to pass an electric current through the solution to form this deposit. This technique is used to prevent corrosion and wear. EN plating provides an even deposit regardless of workpiece geometry and can be deposited on non-conductive surfaces. Benefits of EN plating include increased wear resistance, hardness and corrosion protection. Applications include oil field valves, rotors, drive shafts, paper handling equipment, fuel rails and electrical/mechanical tools. It is also commonly used as a coating in printed circuit board manufacturing.

Coating

Coatings are coverings that are applied to the surface of an object, usually referred to as the substrate. Coatings are often applied to improve surface properties of the substrate, such as appearance, adhesion, wetability, corrosion resistance, wear resistance, and scratch resistance.

- **Electrocoating** – Also known as electo deposition, it uses electrical current to deposit organic paint on a metal surface. Metal parts are charged with direct current and then immersed in a bath that has oppositely charged paint partials in it. This allows every corner, crack, and crevice to have a continuous even coating over the entire surface of the part. Electrocoating provides corrosion resistance and stain resistance, and can improve hardness as well. It is often used for automotive parts, agricultural components, appliances, fasteners, laboratory equipment and many hand tools.

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Surface Finish Processes for Metals (con't)

- **Black Oxide Coating** – Black oxide, or blackening, is a coating used on ferrous materials, copper and copper based alloys, zinc, powdered metals, and silver solder to provide mild corrosion resistance and improved lubricity. Black Oxides on Stainless steel and/or brass alloys will yield excellent corrosion protection. One of its advantages over other coatings is its minimal buildup. Black oxide coatings are widely used in the machine tool, automotive, appliance and general metal forming industries.

- **Teflon Coating -** Teflon, or polytetraflouroethylene (PTFE), is a synthetic fluoropolymer which finds numerous applications across a wide range of products. PTFE is used as a non-stick coating for items such as tools and cookware. It is very non-reactive, and therefore is often used in containers and pipe work for reactive and corrosive chemicals. It is also used as a lubricant, to reduce friction and wear of machinery and component parts. Hyde IBS uses both standard and food-grade PTFE coatings.

- **TiN Coating** – TiN, or titanium nitride, is an extremely hard ceramic material, often used as a coating on titanium alloys, steel, carbide, and aluminum components to improve the substrate's surface properties, such as edge retention and corrosion resistance. Applied as a thin coating, TiN is used to harden and protect cutting and sliding surfaces and as a non-toxic exterior for medical implants. TiN coatings often improve the life of tooling by a factor of three or more.

Treatments

Surface treatments are a broad range of processes that add to or alter the surface of a part or component to improve appearance, adhesion, solderability, corrosion resistance, electrical conductivity, tarnish resistance, chemical resistance, wear resistance or hardness. Treatments can also be used to remove burrs and other surface flaws and to reduce brittleness and friction.

- **Cryogenic Treatment -** Cryogenic treatment is a steel tempering process where material is processed at extremely low temperatures (approximately -300°F / -190°C), which results in modification of its microstructure and improvement of its properties. Cryogenic treatment is carried out as a supplemental process following conventional heat treating procedures.

  Benefits of cryogenic treatment include enhancements to wear resistance, mechanical strength, toughness and fatigue strength. Cryogenic treatmnent can also reduce friction and enhance the machining, grinding and polishing of steels. Cryogenic treatment of steel is most commonly used on cutting tools (sawing, milling, drilling, broaching, turning, slitting, shearing), molds and dies, punches and high precision parts or high performance parts.