

Vacuum Metalizing Applications

Skill Level  Time  Cost 

“Vacuum metalizing is the process of evaporating metals (most commonly aluminium) inside a vacuum chamber to achieve a uniform metalized layer”, says Mr. Glenn Mueller, Vice President of Mueller Corporation, a leading provider of vacuum metalizing services. “It is utilized for different applications, including EMI/RFI shielding, as a chrome alternative, for decorative metallic finishes, to create highly reflective coatings, heat shielding, and others. The different finishes include chrome, gold, bronze, colored chrome, and matte metallics such as satin nickel and matte silver”.

“3-D printing using Objet’s systems provides an excellent solution for those who search for vacuum metalizing applications,” add Mr. Glenn Mueller. “Demanding high quality printing with remarkably fine details, such models can be produced easily using PolyJet™ Technology due to the ultra-thin layer thickness and high printing resolution.”

The Process

The vacuum deposition process is a physical, rather than electrochemical, method of depositing metals onto a substrate. The deposition takes place within a vacuum chamber where metal is melted and then becomes gaseous when it reaches its vapor point. Gas molecules traveling by line of sight then condense on the desired substrate, creating a relatively uniform coating. The vacuum system itself consists of an airtight chamber where the deposition process occurs. Outside the chamber, multiple pumps evacuate air to the desired process pressure. A power supply is used to deliver the required voltage to an electrode, which connects a series of stand-offs holding tungsten filaments loaded with the desired metal for vaporizing.

There are eight to ten major steps in the vacuum metalizing process. A typical application may take between two to three hours for completion. The substrates that work well for vacuum metalizing include metal (tin, steel, aluminum, etc.), plastic (ABS, polypropylene, styrene, etc.) and glass.



Picture 1. Chamber ready for fixtures



Picture 2. Parts emerging from chamber



Picture 3. The vacuum chamber

To achieve a brilliant blemish-free coating, the raw substrate must be free of surface contamination, such as mold releases, fingerprints, dirt, dust, oil and grease.

The first step in the process is to assemble the parts on production racks. Parts need to be held securely as they go through a variety of painting and metalizing processes. This is usually done with circular racks made of steel and welded together in various configurations. Usually, spring-type clips, mounted onto the racks, are utilized. Part design can be important because clip marks or scars can be left where the part is attached to the rack. Typically, parts for metalizing can have holes, ribs, pins or a small section of a runner on them for holding in areas on the parts that are not critical Class A surfaces. Base or primer coating is added after the parts have been through a destatic blow-off area. The base coat is applied with HVLP guns utilizing automated reciprocating and robotic spray paint lines.

Base coating acts as an adhesion-promoting layer between the substrate and the metalizing and thus the base coating creates a smooth reflective surface. After the basecoat is applied, the racks are placed in a bake oven for curing. The bake cycle is approximately one to two hours. Racks are then ready to be placed into the vacuum chamber to be metalized. After metalizing the racks are again placed into the paint lines to receive a clear or tinted topcoat which protects the thin layer of aluminum from wear and abrasion and transforms the bright chrome into the different finishes available. The top coat-painted racks then go through a bake cycle to cure the top coat.

Reader's Note:

Vacuum metalizing can replace more costly electro-plating as a decorating option in many applications, such as reflectors, toys, point of purchase displays, caps, closures, trophies and household hardware, and more.

Disclaimer

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Information and pictures in this applications note are curtesy of Mr. Glenn Mueller, Vice President of Mueller Corporation.
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Picture 4. PolyJet model coated with gold finish



Picture 5. PolyJet model coated with chrome finish



Picture 6. Vacuum metalizing samples

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