Silver-Indium Plating

Parker Hannifin's silver-indium plating is a patent-pending electrodeposited plating process developed for metal seals and sealing components exposed to hot, oxidizing environments.

Silver-indium plating utilizes a unique heat treatment process to diffuse indium into a standard silver matrix, producing a soft but robust intermetallic coating that is more resistant to high temperature blistering than either plain silver or silver-gold composite coatings.

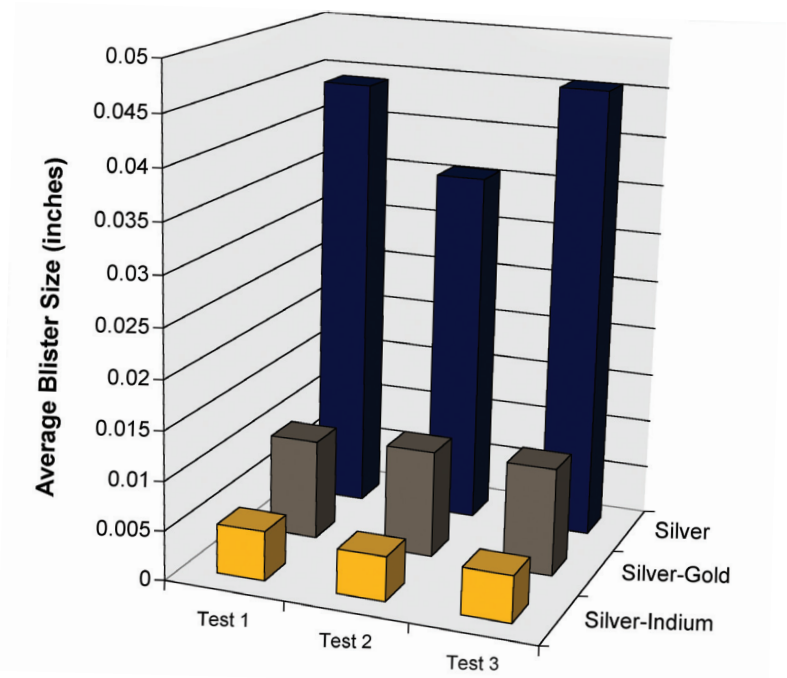

Figure 1: Average blister size of silver, silver-gold, and silver-indium samples after 500 hours in air at 1150°F (621°C).

Current Plating Technology

Silver plating is typically used to improve the performance of static metal seals by providing a ductile outer layer capable of conforming to irregularities in the mating hardware. However, silver is easily permeated by oxygen at elevated temperatures, leading to oxidation of the underlying substrate. This oxidation can cause the silver plating to blister and lose adhesion.

One method often used to combat silver blistering incorporates a thin layer of gold between the substrate and the silver plating. Although effective at lower application temperatures, this method is prohibitively expensive for general or high-volume use.

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Figure 2: Blisters seen on a standard silver plated seal after 500 hours in air at 400°F (204°C).

Figure 3: Silver-indium sample exhibits virtually no blisters after 500 hours in air at 1150°F (621°C).

The Parker Solution

Parker's solution is specifically engineered to minimize the blistering and subsequent delamination commonly seen in silver and silver-gold composite coatings exposed to hot, oxidizing environments. The diffused indium in Parker's intermetallic plating prevents oxygen diffusion through the plating layer in two ways. First, the indium binds to oxygen at both the surface and within the plating matrix, forming stable oxides. Second, the indium fills interstitial voids within the silver plating matrix, effectively blocking atomic diffusion of oxygen atoms, preventing them from reaching the underlying substrate.

Performance

Long-term testing confirms that Parker's new silver-indium diffused plating is significantly better at reducing blister formation and subsequent delamination when compared to plain silver or silver-gold composite coatings. And, because silver-indium retains its ductility during and after high temperature exposure, sealing performance is fully maintained for all conditions.

Applications

Silver-indium plating is suitable for use in applications currently using plain silver or silver-gold composite coatings for enhanced sealing performance, including aerospace, automotive, and heavy duty diesel applications. In addition, the added oxidation resistance provided by silver-indium allows it to be used in high-temperature applications (up to 1150°F) well beyond the capability of standard silver and silver-gold composite coatings.

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