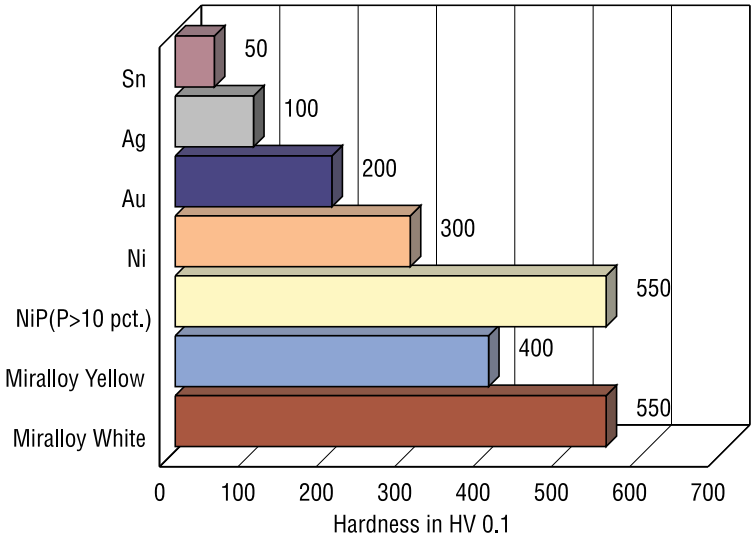
Functional and Decorative Nickel-Free Finish



VICKERS hardness values

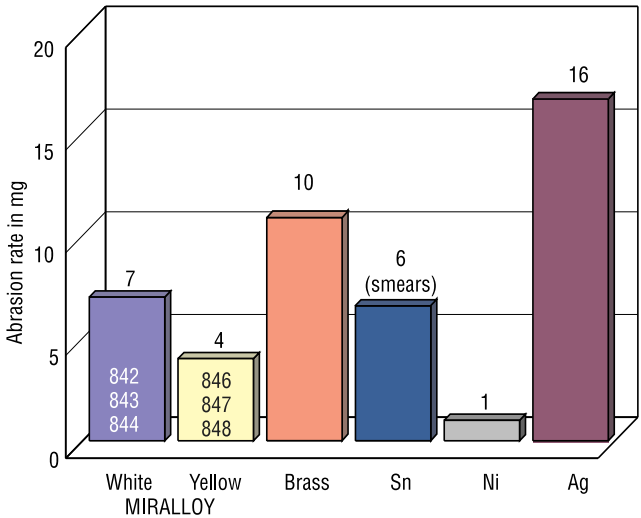
Parts plated in Miralloy® nickel-free baths from Degussa Electroplating, Germany, do not cause contact allergies that may occur in parts plated using nickel. The systems can be used for decorative applications, such as jewelry, but also can be used for functional applications. The copper/tin or copper/tin/zinc baths can be used to plate springs, hydraulic parts, nuts, screws and current-carrying elements.

Tarnish resistance, uniform thickness distribution and good wear and corrosion resistance are characteristics that make the finish suitable for functional applications. A yellow or white finish can be achieved, depending on the bath and alloy composition.

White deposits have an average of 55 pct copper and 45 pct tin. Yellow finishes have an average of 80 pct copper and 20 pct tin, or 80 pct copper, 17.5 pct tin and 2.5 pct zinc. Alloy composition depends little on the current density applied, which can range from one to seven amps/sq dm.

The finish can be applied to almost any base metal after pretreatment. Materials containing iron, nickel and steel and some castings must be preplated with copper in a cyanide bath with a pH less than 11 and a coating thickness of at least five micrometers.

The copper/tin systems produce white deposits. There is also a binary bath that produces a yellow final finish on functional parts. The ternary systems contain zinc as an additional alloy, primarily for decorative yellow finishes. The zinc ensures a uniform yellow coating.



ABRASION resistance using Erichsen tests

Hardness depends on the tin content of the bath. White layers have a hardness of 550HV. Yellow deposits have a hardness of 400HV. The high hardness provides for good wear resistance.

White finishes two to five microns thick are also highly corrosion resistant, as determined by DIN 50 021 SS salt spray test. During thermal cycling, yellow coatings show a thin, uniform corrosion layer after five cycles. However, the base metal showed no corrosion.

Coating distribution is uniform. In contrast to bright nickel, the distribution is nearly uniform over the entire current density range. Throwing power is approximately 60 pct, measured in a Haring-Blum cell.

During a 16-hr temperature treatment at 155C, there was no color change in a white deposit on brass, and zinc diffused out of the brass cannot be detected in the nickel-free layer. The white coating acts as a barrier, therefore it can be directly deposited on brass without an intermediate copper layer.

As a final layer, white finishes have a higher reflectivity than silver, even after aging. Yellow coatings were found to be more tarnish resistant then electrodeposited brass coatings.

Nickel-free baths were primarily developed for decorative applications to prevent contact allergies. However, this coating can also be used for functional applications because of its hardness, wear resistance and uniform deposition. **PF**

Source: Degussa Corp., Frankfurt, Germany.