MIDWEST TUNGSTEN SERVICE

Tips

Evaporating Gold Colors

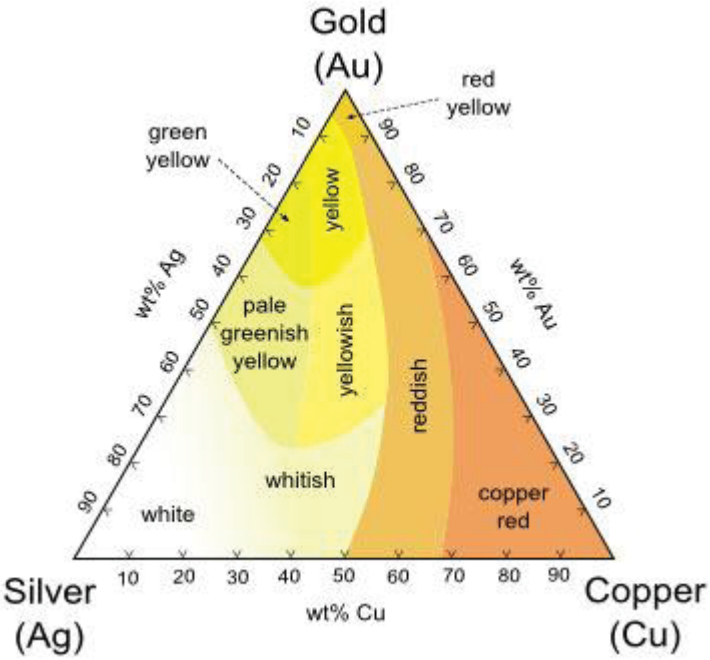
Published now and again *by MIDWEST TUNGSTEN SERVICE*

In several of our TIPs, we mention the evaporation of gold and gold colored materials. This TIPs explores the subject in greater depth.

Many metallizers achieve gold colors by evaporating aluminum and the applying a colored top coat lacquer. This has the advantage of being inexpensive and allowing for good color matching. On the down side, color control can be difficult, additional operations may be required, and the color can fade over time. See our TIPs, Dip Dyes, for more information. Some people wish to avoid these problems by depositing a gold colored evaporant.

When discussing the evaporation of gold colors, there are two primary areas that must be dealt with. The first is how we determine and define what constitutes a gold color. The second is what colors can be practically evaporated. In short, can someone get the color they want? Our response to someone inquiring is that yes, they can achieve a gold colored deposition, but the likelihood that they will achieve a color match to a specific gold color is very slim.

The color of pure, 24 karat gold is an unchanging standard. Beyond that, things become more challenging. Gold is very often alloyed with other metals, not only to alter the properties, but also to alter the color. The colors achieved fall in a range that includes white, green, yellow, red, and brown. The chart below shows a color map for actual gold alloys.



Pure gold and gold alloys can be evaporated, but in most cases they are not used for decorative applications because of the cost of gold, the difficulty in recovering unused gold, the poor adhesion of gold, and the softness of the film. A great deal of time and effort has been expended to develop an alloy that would simulate gold, but with better properties and lower cost.

When we consider gold toned alloys, the first two categories of material that come to mind are brasses and bronzes. Brasses are alloys of copper and zinc, and sometimes lead in varying ratios. Bronzes are alloys of copper and tin perhaps with additional elements such as phosphorus, manganese, aluminium, or silicon. At a vacuum of 10^{-4} torr, copper evaporates at 1017ºC, tin evaporates at 997ºC, and zinc at 250ºC. This tells us that if we evaporate brass, the zinc will evaporate first, and will then be covered by a layer of copper. This is not what we want and will result in a coating that is silver colored on one side and copper colored on the other. Additionally, any amount of lead in the vacuum chamber should be avoided due to toxicity issues. Bronze is a better choice since the evaporation temperatures of copper and tin are close. With careful execution, it is possible to have both the copper and tin evaporate together, giving a gold colored result. The other metals that can be present will have an effect on wetting, evaporation, and coloration. Silicon bronze deposits with a brownish copper color. Aluminum bronze is a better choice for gold colors. Midwest Tungsten Service sells both.

l to r: aluminum bronze, silicon bronze, nichrome, aluminum

So, what can we expect to achieve when evaporating aluminum bronze? Efforts to achieve color matches to other parts or to color chips are usually exercises in frustration, and we would discourage the attempt. Properly done, an aluminum bronze evaporation will yield a color that is best described as yellow with a bit of brown. Improperly done, the result will be silvery or very brown. The best way to fire this material is hot and fast in order to keep the metals together during evaporation. It is also important to control the firing parameters and the partial pressure of oxygen from cycle to cycle in order to produce consistent results. It should also be mentioned that coverage is not as good as with aluminum and it may be necessary to add additional filaments in order to achieve proper coverage. If the operator is familiar with evaporating copper, the process for bronze is similar. The increased density of the material increases the likelihood that molten material will drip from the filament, so basket filaments are usually used to prevent this problem. Contact us for more detailed information on depositing gold colors.

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