Wire Facts

Plating Thickness Measurements Gold, Palladium, Silver

Copper and copper alloy wire is often electroplated with precious metal coatings. These coatings can be singular as in the case of silver plated copper or they can be of multiple layers as in nickel-gold or nickel-palladium-gold plated copper alloy wire.

The performance characteristics of pure precious metal deposits can be enhanced with alloying additives. As an example, nickel or cobalt can be added to gold to produce a 'Hard' gold surface. In developing the desired performance of the plating deposit these additives also change the density of the plating. This in turn affects the measurement of the plating thickness.

Precious metal plating is most accurately measured with x-ray fluorescence techniques. The plated wire is subjected to an x-ray beam and the x-ray fluorescence characteristic of the plating is emitted. The fluoresced x-ray is detected by a counter. Using the number of counts over the sampling time, the density of the deposit, the fluorescence and absorbence constants, a deposit thickness is calculated. Since this is a calculated value, standardization and correlation procedures are employed to ensure precision and accuracy. Thickness standards with certified values and densities are used to calibrate the measuring equipment. The x-ray fluorescence technique only measures thickness based on an assumed density. The actual density of the deposit is very difficult to measure so it's value must be selected from a recognized range prior to thickness measurement.

As with any instrumentation, the accuracy and precision are in accordance with the standards used. The 'raw error' in x-ray fluorescence is generally held to be ±5% and represents the uncertainty of the measurement technique itself. If the density for the plated deposit is incorrectly assigned to the thickness calculating algorithm the resulting determined thickness value can be substantially different from the 'real' plated thickness value.

Sampled area as determined by the spot size of the collimator also has bearing on the measured value. Generally accepted practice is to use a collimator size that is no more than half and preferably one third of the dimension of the wire surface being measured. This is especially critical for round wire.

Sampling times are to be considered. Longer sampling times yield more counts and therefore better certainty although there is diminishing benefit from sampling times beyond one minute.

Sample position is also important. Samples should lie flat and the sample needs to be staged at the correct height in the measuring instrument. Incorrect sample height can induce a 10-15% measurement error. The sample must be positioned so that the collimator beam falls along the centerline of a straight piece of wire.

To reproduce precious metal thickness readings to within the recognized range of accuracy for x-ray fluorescence using different test equipment at different locations, the following factors must be established:

Sample Spot
Collimator Size
Sampling Time
Density Value

Accepted density value for various precious metal platings are as follows:

Deposit Type	Density Value
Pure Gold	19.3 gm/cm^3
'Hard' Gold	15.7 - 17.9 gm/cm^3
Palladium	10.7 - 11.7 gm/cm^3
Silver	10.5 gm/cm^3

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