National Institute of Standards & Technology

Certificate

Standard Reference Material 2321

Certified Coating Mass and Composition Reference Standard

Tin-Lead Alloy Coating on Copper

This Standard Reference Material (SRM) is intended for use in calibrating x-ray fluorescence instruments for the measurement of mass per unit area and composition of tin-lead alloys deposited on a copper substrate. The SRM consists of a 15 x 15 mm plate of an electroplated tin-lead alloy coating on a copper substrate. The plate is mounted in a recess in a plastic holder.

The mass per unit area and the percent tin are certified to be within 5% relative to the given value at the center of the SRM, and to the average over the entire surface. The certified values for composition and mass per unit area are given below and are also printed on the plastic box containing this specimen. The nominal of the alloy is 60% tin and 40% lead.

Specimen Serial No. Composition (wt. % Sn)

Mass Per Unit Area (mg/cm^2)

An approximate thickness of the alloy coating can be estimated from the measured mass per unit area, the measured composition, and the density (literature value) using the formula:

$$\text{Thickness } (\mu m) = \frac{\text{mass per unit area } (mg/cm^2) \times 10}{\text{density of alloy } (g/cm^3)}$$

The following expression can be used to estimate density of a tin-lead alloy:

$$\text{Density } (g/cm^3) = \frac{\text{density of Sn x density of Pb}}{(\text{density of Sn})(1\text{-}F) + (\text{density of Pb})(F)}$$

F = mass fraction of tin in alloy
Density of tin = 7.29 g/cm^2
Density of lead = 11.34 g/cm^2

The tin-lead alloy coating was characterized by a combination energy dispersive x-ray fluorescence, atomic absorption, and gravimetric analyses.

The overall direction and coordination of the technical efforts leading to the certification of this Standard Reference Material were performed under the direction of Dr. David S. Lashmore, of the Laboratory for Materials Science and Engineering, Metallurgy Division.

Special thanks is extended to Fielding Ogburn for his assistance in the research and certification effort.

The standard was certified by Perry Sharpless of the Laboratory for Materials Science and Engineering, Electrodeposition Group.

Gaithersburg, MD 20899
June 10, 1991

William P. Reed, Chief
Standard Reference Materials Program

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The statistical review of the data for certification was performed by S. Schiller of the Statistical Engineering Division.

The support aspects involved in the issuance of this SRM were coordinated through the Standard Reference Materials Program by T.E. Gills.

Supplemental Information

It should be noted that tin-lead alloys age with time, with the highest rate of change occurring immediately after plating. This change is noted in the ratio of the tin to lead count rates, which peaks at a maximum of approximately 2% about 4 months after plating. This sample was aged before certification. For more information see Plating and Surface Finishing, Vol. 75, November 1988, pp. 58-59.

To protect the surface from damage, the standard was coated with a thin acrylic lacquer which does not affect x-ray measurements.

The certified values are no longer valid when the alloy is visibly worn or damaged.