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A Suitable Pin Material for Glass-to-Metal Seals

MULTICOMPONENT ALLOY CONTAINS PLATINUM AND PALLADIUM

Contact with an electronic device hermetically sealed within a canister is made by means of metallic pins that exit through a header, and are insulated from the header by a glass which also seals the canister. Such individual devices are formed into larger electronic assemblies by connections soldered to the conductor pins. These pins must have good strength and ductility, suitable conductivity, must be compatible with the usual solders, and form an hermetic seal with glass. Iron-nickel alloys are commonly used for this purpose, even though they are not wet readily by near-eutectic tin-lead solders. In current practice this disadvantage is overcome by plating the pin with nickel and then gold, but this metallised layer is prone to damage prior to the soldering operation.

In searching for a material with all necessary properties researchers at the Sandia National Laboratories, Albuquerque, have made a metallurgical study of alloy Paliney 7™, which is a multicomponent alloy sold by the Ney Company (D. R. Frear, J. R. Michael and P. F. Hlava, "Analysis of the Reaction between 60Sn-40Pd Solder with a Pd-Pt-Ag-Cu-Au Alloy", *J. Electron. Mater.*, 1993, **22**, (2), 185–194).

Some of the properties of this alloy have been established by others, but there is no published information on the reaction between Paliney 7™ and tin-lead solder or on the reliability of the resultant solder joint. The current study has shown, however, that the wetting properties of 35 palladium-30 silver-14 copper-10 gold-10 platinum-1 zinc (weight per cent) are comparable to those of metallised gold-nickel, and result in good mechanical bonds. Also the multicomponent alloy retains ductility and strength after heat treatment tests designed to simulate the thermal conditions encountered during the formation of glass-to-metal seals. The intermetallic layer formed between the pin alloy and the 60 tin-40 lead solder consists mainly of $PdSn_4$, with platinum and gold substituting for palladium in the crystal structure; the structure is fine grained with extensive twin growth which prevents excessive brittleness. It is concluded that 35 palladium-30 silver-14 copper-10 gold-10 platinum-1 zinc is a suitable conductor pin material for glass-to-metal sealing applications in electronic packaging.

Platinum Foil in Ceramic Bonding

The solid state reaction that takes place between many ceramics and metals can be used to produce strong vacuum-tight joints which maintain their strength and durability even at elevated temperature, and the use of platinum foil for this purpose was reported here in 1981.

Reaction bonding to ceramics is best performed with platinum, which has a high melting point, is oxidation and corrosion resistant and therefore is the preferred metal for many bonding applications used in many hostile environments.

Now researchers at Lawrence Berkeley Laboratory, University of California, Berkeley, have developed a ceramic-ceramic joining method, partial transient liquid-phase bonding, that uses a thin foil of platinum to join copper coated alumina surfaces (M. L. Shalz, B. J. Dalgleish, A. P. Tomsia and A. M. Glaeser, "Ceramic Joining. Part I. Partial Transient Liquid-Phase Bonding of Alumina via Cu/Pt Interlayers", *J. Mater. Sci.*, 1993, **28**, (6), 1673–1684).

High purity platinum foil was placed between two layers of alumina coated with thin layers of copper. Partial transient liquid-phase bonding was achieved through this copper/platinum interface at 1150°C, yielding a platinum-rich interlayer and giving high-strength joints between platinum and alumina, at much lower temperatures than those required for conventional diffusion bonding. Flexure tests also showed that the obtained ceramic/metal interface strengths were higher than normally achieved for ceramics.