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An Alternative Lead Free Electronics Assembly Technology

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Although much of the current discussion of the transition to lead-free electronics assembly technologies is based on the presumption that the alloy that will replace “63/37” in most applications will be the tin-3%silver-0.5%copper alloy (commonly known as “SAC305”) there is already established and in use in volume commercial production for more than five years a viable alternative technology based on the nickel-modified tin-copper eutectic.

The nickel-modified tin-copper eutectic can be used at all points in the production of electronic equipment where tin-lead solder has previously been used- as a solderable finish, a wave solder alloy, a reflow alloy, a high temperature dipping alloy and as a flux cored wire for hand soldering. And it is being evaluated as an alloy for BGA spheres.

In hot air solder levelling (HASL) of printed circuit boards the nickel-modified tin-copper eutectic provides a finish that is actually superior to that typically obtained with tin-lead in terms of the minimum thickness and evenness of the coating. The independently confirmed stabilising effect of the nickel addition on the growth of the intermetallic layer ensures a long solderable shelf life for printed circuit boards with this finish. Variants with a low copper erosion tendency at high temperatures are being used for the hot-dip coating of component terminations to achieve a long shelf life solderable finish. In wave soldering the excellent fluidity of the nickel-modified tin-copper eutectic ensures good through hole filling with minimal bridging and bright smooth fillets. For most boards excellent soldering can be achieved with solder temperatures similar to those used for a similar boards when soldering with tin-lead. In reflow the higher melting point (227°C) necessitates a higher minimum peak temperature than that required by SAC305 but good reflow is being achieved with 245°C peak temperature. And the nickel-modified alloy can be drawn easily to make flux-cored solid wire solder for assembly and repair. In service the high ductility of the nickel-modified tin-copper eutectic results in longer service life in situations where the joint itself has to accommodate strain such as when subject to vibration.

In this paper the authors will describe the alloy, the equipment and the process parameters being used to get optimum results with this alternative lead-free technology and compare its properties and performance with other widely promoted lead-free solders. The objective will be to assist those in the process of choosing a lead-free solder to understand the issues that have to be considered and the choices available.