Soldering of Commercial BGAs and CSPs to Low Cost Flexible Substrates for Wearable Medical Monitors

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Abstract

Off the shelf Ball Grid Array (BGA) and Chip Scale Package (CSP) components are almost always offered with SnAgCu balls with either 3% or 4% Ag. Depending on the quantities required custom orders of components with another alloy may lead to major increases in price. On the other hand, most low cost flexible substrates cannot survive the process temperatures involved in SnAgCu reflow. One alternative under consideration is therefore to use a eutectic Sn-Bi solder paste. With a melting point of 139C such a paste may solder well to a contact pad with a peak reflow temperature as low as 160C. However, the partial intermixing of the alloys when soldering to SnAgCu provides for a range of properties that may vary significantly with the combination of design and process details. The consequences of this do, of course, depend on the product use conditions.

The present work focused on a flexible patient monitor to be worn in a hospital on an ongoing basis over a period of 3-5 days and then disposed of. This means that the product needs to be mechanically robust and survive low cycle fatigue, while thermal cycling is not a concern. A set of experiments was conducted to assess the effects of paste volume and reflow profiles on solder joint strength and low cycle fatigue resistance. Both strength and fatigue resistance tended to decrease with decreasing peak temperature and paste volume, but indications are that performances comparable to those of conventionally reflowed Tin-Silver-Copper solder joints can be achieved even with laser reflow and a peak temperature as low as 160C. This offers promise for the use of low cost substrates.