ASIA ELECTRONICS

Solder Products Rise up for New Electronic Trends

Different product manufacturing requirements call for specific solder characteristics. SMIC lays out an extensive lineup of solder products for various needs.

About a decade has passed when the trend towards the adoption of lead-free products started. Today, materials are selected according to the purpose or use.

In August 2012, the U.S. Securities and Exchange Commission adopted implementation rules pursuant to section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act relating to the use of conflict minerals. As a result, an increasing number of companies consider that the use of conflict-mineral-free soldering or conflict-mineral-free plating ensures the implementation of corporate social responsibility (CSR) procurement, leading to an increase in their corporate value, and that conflict-mineral-free soldering and plating are minimum requirements to avoid the risk of being excluded from the supply chain.

In 2010, Senju Metal Industry Co., Ltd. (SMIC) inspected all smelters from which SMIC purchases tin in order to make sure that they do not use tin (Sn) produced in Congo, thus declaring "conflict mineral free" and implementing a system of information disclosure and logistics.

However, the number of companies that unknowingly purchase imitations of SMIC's products through inappropriate distribution channels and use them on-site despite adopting SMIC's actual products is on the rise. As a result, problems, such as falsification of conflict-mineral reports along with unsatisfactory quality are arising. Soldering products with a similar name to those of SMIC's products are also on the market. Against this fraudulent acts, SMIC has been vigilant in information campaign that the firm is not in technical collaboration with any other solder manufacturers in the area of lead-free soldering.

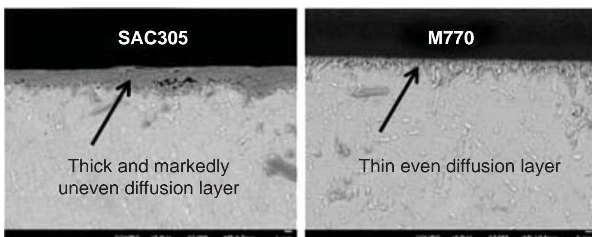

Photo 1: Comparison of interfacial reactions

This year as well, materials with resistance to both drop impact and thermal fatigue are preferred for connections in mobile devices and car electronics. Moreover, fine-pitch micro-soldering are likely to be required for mobile devices and power electronics solutions for car electronics.

M770—Solder Ball with Conflicting Characteristics

As the use of solder balls for connection is increasing every year, the requirements for their characteristics are increasingly becoming strict. SMIC has developed the solder ball product M770 as a material to comply with such strict requirements.

M770 satisfies the requirements by using silver (Ag) to control precipitation, strengthening and applying copper (Cu) or nickel (Ni) to control the interfacial reaction with the connected objects (Photo 1).

M770, also, is highly compatible with all surface finishing materials including Cu-OSP. In December last year, SMIC announced a roadmap for the promotion of fine-pitch bump formation and exhibited a $\phi 20\mu m$ solder ball product for reference. It has already been mass producing solder ball products of up to $\phi 30\mu m$.

SMIC combines its own historic processes with the SPG process to further provide high-sphericity, tight-tolerance, and ultra-micro solder ball products.

PPS Process Allows Mounting of 0201 Parts (Fig. 1)

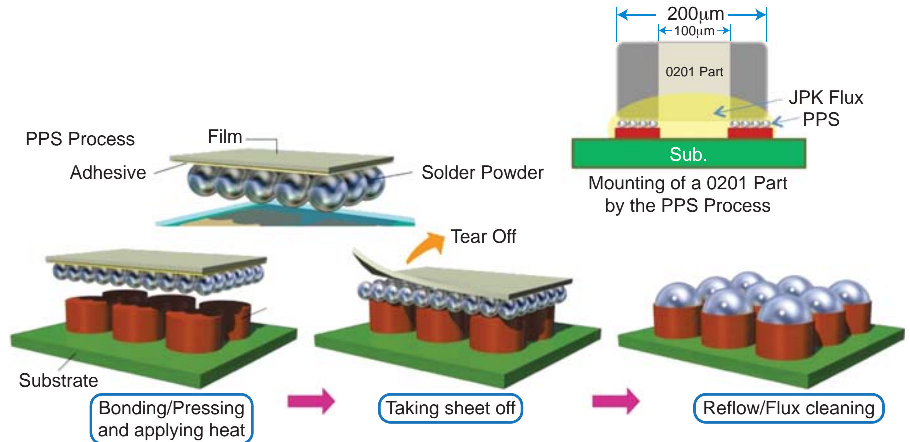

Fig. 1: Soldering by PPS process

While chip parts are becoming more miniaturized every year and 0201-size parts are now developed, the soldering process is being put to question.

SMIC recommends its own Pre-coated by Powder Sheet (PPS) process in order to solve this question. The PPS process is a way of connection that uses a solder transfer sheet, PPS, which is formed by using a plastic sheet consisting of a bonding layer and a base mate-

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rial, and is covered by a layer of solder powder. The method allows formation of bumps of 10μm and pitches of 30μm.

It is quite possible to solder a 0201 part, which is expected to have electrodes of 50 × 100μm and pitches of 100μm, by thermally transferring solder onto its pad through a PPS and applying flux to it. As the bonding strength is commensurate to the amount of solder, this soldering method should be used for electrical connection. In order to provide an improved mechanical connection, JPK flux, in which flux residue serves as adhesive, should be used.

Formation of Fine Pitches

During fabrication of mobile devices, fine-pitch soldering on an ultra-micro scale that seemingly cannot be performed in a reflow oven is frequently required.

In order to deal with such an issue, SMIC recommends the ultra-fine-line resin flux cored solder EFC. EFC is φ0.2 to 0.1mm high-quality ultra-fine-line resin flux cored solder designed to reduce disconnection and constriction during wire drawing by means of SMIC's own wire drawing technology that it has developed over a long period of time. This wire drawing technology, moreover, puts flux in the center of an even ultra-fine line to reduce flux spattering and to prevent the occurrence of solder bridging, achieving sharp ultra-micro connection.

Also, SMIC has developed a flat core where ultra-fine-line resin flux cored solder is shaped into ellipses to prevent them from rolling, providing the specifications for allowing reflow-method fabrication of fine-pitch connectors and the like (Fig. 2).

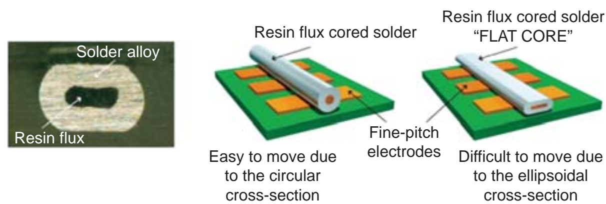


Fig. 2: Formation of fine pitches in a reflow oven with ultra-fine resin flux cored solder FLAT CORE

Solder Paste M47 Further Lowers Costs

Due to a surge in silver prices, materials with low-Ag content are gaining a central role in soldering. Simply reducing the content of Ag, however, leads to a decrease in reliability.

In order to further lower costs, SMIC developed M47-LS730, which has a reliability comparable to M705 (Ag content of 3%), without using the rare metal indium (In). M47-LS730 is a high-quality product with an Ag content of 0.3% that reduces the occurrence of solder voiding and flux residue and prevents formation of solder balls due to moisture absorption.

Also, the product uses a new additive instead of In to increase the reliability of its failure mode in order to delay the development of solder cracking that occurs during temperature cycle testing (Photo 2).

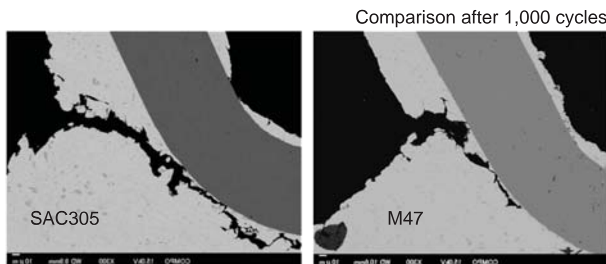
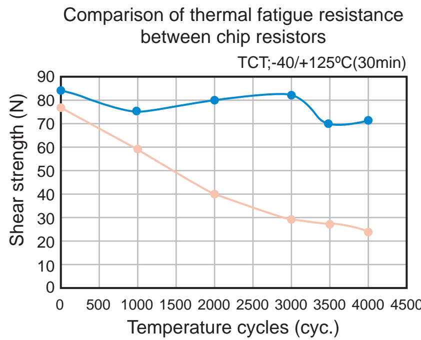


Photo 2: Improved failure mode where the development of cracks is delayed by a new additive

Lead-Free Car Electronics Trend

The lead-free trend in car electric/electronic devices, which is slow as compared to that in other electric/electronic devices, is likely to gain ground. A major reason for the delay is the long time it took to satisfy legal restrictions in the European Union and to eliminate concerns over reliability for use as car electronics. SMIC solved these issues by developing M53 solder paste for car electronics.



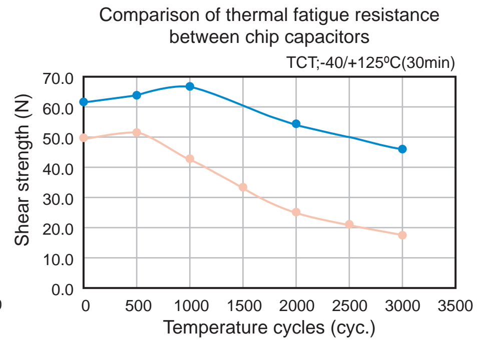


Fig. 3: Comparison of thermal fatigue characteristics between SAC305S and M53

M53 is a high-strength, high-stress-relaxability alloy that is formed through precipitation strengthening of Ag and, in addition, solid-solution strengthening accelerated by combined addition of Bi and In. The alloy inhibits the development of solder cracking, and prevents a reduction in the joint strength even after 3000 cycles (Fig. 3). As, electric/electronic devices have also become increasingly miniaturized in order to increase interior comfort, M53 ensures high quality even in a light, thin, short, and small design with small soldering lands.

Preventing Cracks in Flux Residue to Ensure High-reliability

Dew condensation often occurs in car electric/electronic devices because they are hermetically sealed in a temperature cycle. This temperature cycle causes a crack to appear in the flux residue of the resin flux cored solder and condensation water falls into the crack, resulting in short circuit due to migration during application of voltage.

SMIC solved this issue by developing the resin flux cored solder MACROS, which prevents cracks in flux residue even after a thermal impact. MACROS is a resin flux cored solder product that do not cause a short circuit even during water drop migration testing after application of a thermal impact or during migration testing in a high temperature and humidity. Moreover, it is well compatible with laser soldering and prevents laser-fic flux spattering.

About This Article:

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