

Alloy Additive Makes Thermal Fatigue-, Drop Impact-Resistant Solder

Senju Metal Industry Co., Ltd. has produced Eco Solder Ball M770, a solder ball product resistant to both thermal fatigue and drop impact.

As mobile devices, such as smartphones and tablet computers, incorporate a large number of high-density components mounted using ball grid array (BGA), chip size package (CSP) and the like, soldering materials for connections need to offer resistance to drop impact while allowing formation of more fine-pitch bumps.

There are a variety of surface finishing materials, including copper (Cu), nickel (Ni), and gold (Au), for substrates that provide ball connections, such as BGA and CSP, and each of the materials needs to have high connection reliability. It was thought that the resistance to thermal fatigue and that to drop impact were incompatible features of a material for solder joints and that it was difficult to have them both. The company, however, has developed Eco Solder Ball M770, which satisfies both of these two requirements.

Resistance Evaluations

Thermal cycle testing is a common method of evaluating the resistance of solder joints to thermal fatigue. During this testing, in the fracture mode of a solder joint, a crack develops in solder bulk, resulting in a fracture. This frac-

ture becomes a fault that reduces the mechanical strength, causing an electrical disconnect. This fracture mode is caused by subjecting the solder bulk to thermal stress associated with a change in the temperature. The resistance to thermal fatigue has been improved by precipitation strengthening through which silver (Ag) and other elements are added to separate compounds in the bulk in the form of a network.

In the fracture mode under drop impact, unlike that in thermal cycle testing, a crack develops near the bonding interface, leading to a fracture. In this case, the strain rate at the joint under drop impact is very high, and the fracture occurs near brittle intermetallic compounds formed at the bonding interface, reducing the mechanical strength of connection and becoming a failure that makes electrical connection impossible.

To provide the resistance to both thermal fatigue and drop impact, Ag is added to solder to strengthen the solder bulk. In this case, the resistance depends on the amount of added Ag. If the amount is small, only a very small amount of the Ag₃Sn (tin) compound is formed in the solder composition and thus the effect of precipitation strengthening is weak. If it is large, the Ag₃Sn compound is finely formed in the form of a network to ensure sufficient bulk strength, but the composition is deficient in the ability to reduce stress.



Eco Solder Ball M770 manufactured by Senju Metal Industry

By optimizing the additive amount, the company developed an alloy composition that is effective in both strengthening solder bulk and reducing stress.

To improve the resistance to drop impact, the composition of the bonding interface was examined. When a solder joint is made, various intermetallic compounds are formed at the bonding interface. The resistance to drop impact depends on the types of these compounds and the conditions of the formation, such as density and thickness. It is thus important to control the interfacial structure by forming solder alloy.

Cu and Ni are common materials for finishing the surface of a substrate. Technologies for preventing excessive development of compound layers and increases in particle sizes are important for controlling the structure of the interface with a surface finished by such materials. Thus, adding chemical elements and optimizing the additive amount allowed the formation of a fine, extremely thin, miniaturized interfacial structure. □

SMK Develops Panel-Mounted Connector for PV Module

SMK Corporation has developed the PV-03 Series panel-mounted connector for photovoltaic modules. The plug has a drawing number of CCT9901-27XXF, while the socket is CCT9901-28XXF.

Owing to its D-cut shape, the product's housing is secured to the panel chassis. Easy installation using a nut is also ensured. The terminal ensures

excellent contact performance due to SMK's unique multipoint contact structure. This product is due to acquire TÜV (DIN-EN) safety standard accreditation, so it will be suitable for the European, U.S. and Japanese markets. It features IP67 protection class in relation to the panel chassis' installation and connector mating parts. Further, it uses materials with excel-

lent weather ability and flame retardancy.

This product supports high current of up to 30A, so it can be used for large current equipment, such as storage batteries and photovoltaic power generation related devices, and has a voltage rating of DC 600V and 1,000V. It operates from -40 to +90°C with contact resistance of up to 5mΩ. □