Smart Chemistry Towards Highly Efficient Soldering Material Formulation

ABSTRACT
Driven by environmental and health concerns, the RoHS legislation has mandated the electronic assembly industry to transition from eutectic tin-lead to lead-free soldering, which carries forward a revolution in the formulation of soldering materials. Meanwhile, the fluxing performance has become paramount because of the increasing development and advances in the electronic industry, such as high integration and fine pitch components. Moreover, the demand for halogen-free soldering materials with equal or superior performance compared to their halogenated predecessors makes the design of solder paste, tacky flux and liquid flux formulations even more challenging.

Activator choices are critical parameters in the design of paste and flux formula in order to achieve outstanding performance in lead-free and halogen-free soldering processes. For an efficient printed circuit boards (PCBs) soldering operation, the fluxing mechanism requires the right chemistry coupled with a proper initial heat cycle to remove the oxide and surface contamination. A synergetic combination between chemistry and processing will promote a clean and solder-wettable metal surface, which is a prerequisite to achieve good metallurgical bonding. Meanwhile, the activator itself has to remain inert at mild temperatures to guarantee an acceptable shelf-life while leaving non-corrosive and non-conductive residues to ensure a high-reliability in the no-clean categories.

Here, we report a systematic study of a series of innovative activator systems applied in new solder paste and liquid flux platforms. Analytical methods such as thermogravimetric analysis (TGA) are applied to characterize the thermal behavior of these activators. Solder pastes are formulated using these activator packages. The solderabilities, physical properties and stabilities of the paste and fluxes are evaluated. This fundamental understanding may provide some scientific guidance for future formulation work.

Key words: Lead-free, halogen-free, formulation, activator, fluxing chemistry