Development of Pb-free and Halogen-free Nanosolder-Enabled Solder Pastes

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Abstract

When compared to their Pb-based counterparts, Pb-free solders and their associated higher melting temperatures require higher processing temperatures and additional energy consumption during reflow operations. This can create reliability issues for electronic devices because of the increased thermal stresses. Due to the melting temperature depression that occurs in particles smaller than 25 nm, Pb-free nanosolder particles are strong replacement candidates. Circuit board size constraints also points to nanosolders as promising materials with decreasing feature sizes in electronics assembly and packaging processes. This poster will provide research results for Pb-free and halogen-free nanosolder enabled pastes for use in electronics assembly and packaging applications. Tin/silver (Sn/Ag) nanoparticles (Ag 3.5 – 5 wt. %) were synthesized using a surfactant-assisted chemical reduction method in an aqueous environment. The nanosolder particles were then characterized by SEM, TEM, XRD and DSC. Nanosolder pastes were prepared by mixing Sn/Ag nanoparticles with halogen-free flux of varying mass ratios.

Nanosolder pastes with as high as 85 wt. % have been printed and reflowed on Cu substrates with processes imitating those currently used in the electronics industry. In addition, composite pastes were prepared with commercially available micron-sized solders and as-prepared nanoparticles. As much as 5 wt. % Sn/Ag nanoparticles were added to microsolders to form the halogen-free composite paste. Wettability and intermetallic compounds formed with the substrate have been studied as well.