Effect of Gold Addition on the Melting Point of Selected Lead-free Alloys

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The use of lead-free alloys on circuit boards is steadily increasing both abroad and in US markets. The Sn-Ag-Cu SAC alloys are a common type of lead-free alloys in use. The SAC alloys have been reported to readily, and rapidly, dissolve gold [1]. In order to better understand this behavior we performed a series of experiments where gold was dissolved into three different lead-free alloys and combinations of them. The three alloys were SAC305, 387, and 405. We found that gold did readily dissolve into the lead-free alloy and lead to a quaternary eutectic with a melting point in the range of 205°C, or about 13°C less than the eutectic 387 alloy. The addition of lower amounts of gold resulted in a second, lower temperature, peak in the DTA endotherms. Increasing the gold concentration resulted in the 205°C peak being the dominate peak. The gold concentration range where the 205°C peak dominates appears to be fairly broad.

[1] J. Pan, J. Silk, M. Powers, and P. Hyland, Effect of Gold Content on the Reliability of SnAgCu Solder Joints, IPC APEX EXPO Proceedings.