

Research Title: A study on relationship between soldering temperature and time and the formation of intermetallic compounds of Sn-58Bi lead-free solder and Cu substrate

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ABSTRACT

The aim of this research was to develop a mathematical model to relate effect of soldering temperature and time to thickness of intermetallic compound (IMC) layer between Sn-58Bi lead-free solder and copper substrate. Dip soldering was performed to collect the experimental data for modeling. Soldering temperature was at 170, 190 and 210 °C with soldering time of 5, 15 and 25 seconds. The IMC layer found at the soldering interfaces of all soldering conditions was Cu_6Sn_5 . At a constant soldering temperature, thickness of the IMC layer was linearly increased with the increase of soldering time indicating that the IMC layer growth was a linear kinetics and the exponent of the power law model was equal to one. When the soldering time was kept constant, thickness of the IMC layer was well related with the soldering temperature in a second-order polynomial form. Therefore, by these reasons, multiple regression analysis was selected as the modeling approach to combine the linear and polynomial relationship of the IMC growth. The developed mathematical model was verified and showed a high prediction accuracy. The average prediction error was 1.83%.

Keywords : Lead-free solders, Soldering, Intermetallic compounds, Growth model