事例研究

リフロー用はんだの機能性評価

Evaluating the Functionality of Reflow Solder Paste

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The differences in electrical characteristics of solder joints are so small that they are undetectable without the use of special methods. In this study, a simpler way of assessing solder paste functionality is proposed. In place of the electrical characteristics that are generally used to evaluate solder functionality, the proposed method uses mechanical characteristics. Ten different solder compositions (solders A to J) were tested by finding their toughness values from load-displacement curves under shearing force obtained before and after the application of noise factors (high temperature and high humidity, thermal shock, corrosive gas, and electric current). The toughness of a solder joint means the amount of energy that must be applied to fracture it. The results of S/N ratio and sensitivity calculations using these relationships showed that the new type F solder (Sn-Ag-Cu-X) was superior by 3.9 db in its S/N ratio and 1.7 db in sensitivity to the conventional type B solder (Sn-3.0mass % Ag-0.5mass % Cu). After calculation of total loss values for all ten types, type F was finally selected as entailing the smallest loss (56 % less than that of type B). Use of the proposed method enabled a solder paste to be selected that was satisfactory in all regards: quality, reliability, and cost.

Key words : reflow soldering, low Ag solder paste, mechanical properties, electrical properties, load-displacement curve, toughness, solder volume, high temperature and high humidity test, hot-cold thermal shock test, over current, shearing speed, corrosive gas, sensitivity, quality engineering, Taguchi methods, S/N ratio

1. はじめに

現在，電子機器用の標準はんだとして，Pbを含まないSn-3.0mass % Ag-0.5mass % Cu（以下，Sn-3.0Ag-0.5Cuと記述する）はんだが定着している。しかし，近年Agが高騰（こうとう）しており，はんだの値段も上昇しているためコストダウンを目的としたはんだ組成の変更（低Ag化）の要求が高まっている[1)]。一方，低コスト化による信頼性の低下も懸念されるため，はんだ組成の変更には，コストばかりでなく信頼性も考慮しなければならず，慎重な評価

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