A COMPARISON STUDY OF SnAg AND SnCuNiGe ALLOY ON MECHANICAL STRENGTH OF LEAD-FREE BGA SOLDER JOINT ON SELECTIVELY PLATED Ni/Au FINISH

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By
Wong Ken Sheng

A thesis submitted in partial fulfillment
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Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: **A COMPARISON STUDY OF SnAg AND SnCuNiGe ALLOY ON MECHANICAL STRENGTH OF LEAD-FREE BGA SOLDER JOINT ON SELECTIVELY PLATED Ni/Au FINISH** oleh **WONG KEN SHENG,** no. matrik: **UK 13128**, telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Fizik sebagai memenuhi sebahagian daripada keperluan memperolehi Ijazah Sarjana Muda Sains Gunaan (Fizik Elektronik & Instrumentasi), Fakulti Sains dan Teknologi, UMT.

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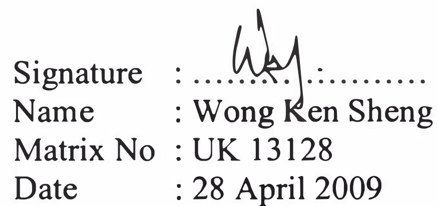
DECLARATION

I hereby declare that this thesis entitled A Comparison Study of Sn-Ag and Sn-Cu-Ni-Ge Alloy on Mechanical Strength of Lead-Free BGA Solder Joint on Selectively Plated Ni/Au Finish is the result of my own work except as cited in references.



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Universiti Malaysia Terengganu (UMT)

A COMPARISON STUDY OF SnAg AND SnCuNiGe ALLOY ON MECHANICAL STRENGTH OF LEAD-FREE BGA SOLDER JOINT ON SELECTIVELY PLATED Ni/Au FINISH

ABSTRACT

In this study, Sn-Cu-Ni-Ge solder alloy was selected for the purpose of lead-free solder joint reliability comparison with Sn-Ag solder alloy on Ball Grid Array (BGA) packages. Ball impact shear and pull tests were performed as assembly, after high temperature storage and multiple reflow to examine the mechanical strength of the solder joint. Sn-Ag alloy performed higher shear and pull strength due to the thinner intermetallic layer formed. Sn-Ag showed zero intermetallic brittle fracture in pull test at variable stress condition. In comparison with Sn-Ag, Sn-Cu-Ni-Ge alloy showed 95~100% brittle fracture. The difference in the strength was due to the intermetallic compound (IMC). The smaller IMC thickness and area of Sn-Ag alloy was due to lower reaction rate of Ni and Sn. As a result, Sn-Ag could provide a better and more reliable solder joint system.

KAJIAN PERBANDINGAN KEKUATAN MEKANIKAL ANTARA SnAg DAN SnCuNiGe BAGI SAMBUNGAN PATERI BEBAS PLUMBUM SUSUNAN GRID BEBOLA BAGI KEMASAN KEPINGAN Ni/Au

ABSTRAK

Dalam projek ini, aloi Sn-Cu-Ni-Ge dan aloi Sn-Ag telah dipilih untuk mengkaji keboleharapan sambungan pateri bebas plumbum pada pakej susunan grid bebola. Ujian ricihan dan tarikan pada bebola pateri telah dijalankan selepas proses penyimpanan dalam suhu tinggi dan pengaliran haba beberapa kali untuk menguji kekuatan mekanikal yang ada pada sambungan pateri. Aloi Sn-Ag menunjukkan kekuatan mekanikal yang lebih tinggi disebabkan oleh lapisan antara logam yang nipis. Sn-Ag tidak mempunyai sebarang kegagalan rapuh dalam ujian tarikan bagi sebarang keadaan tekanan. Namun, aloi Sn-Cu-Ni-Ge menunjukkan 95~100% kegagalan dalam ujian kerapuhan. Ini disebabkan lapisan antara logam yang terhasil. Sebatian antara logam yang nipis didapati di aloi Sn-Ag kerana kadar tindak balas yang rendah antara Ni dan Sn. Sebagai kesimpulan, aloi Sn-Ag menunjukkan ciri-ciri yang lebih baik untuk digunakan dalam sistem sambungan pateri.