International Conference on Lead Free Soldering
Toronto, Canada 16 – 18 May, 2006

Advances in the Understanding of the Behaviour of the Ni-Modified Sn-Cu Eutectic as a Lead-free Solder

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In the paper presented by the authors to the first International Conference on Lead Free Solders in Toronto in 2005 described a Ni-modified Sn-Cu eutectic alloy that was finding successful application as a lead-free solder. Since then as its use in commercial mass production soldering has grown there has been further study of the fundamental metallurgy of the alloy directed at elucidating the basis for its enhanced properties as a solder and identifying ways in which its properties could be further improved. The progress of solidification of the alloy was observed using the dendrite coherency test in which the torque on a paddle rotating in the alloy is measured as a function of time as the alloy cools though its melting point. That study was complemented by the quantification of the practical fluidity of the alloy by measuring the distance it will flow in a capillary at temperatures close to its melting point. The specimens produced in the fluidity test represent a wide range of cooling rates and cross-sections of those specimens provide further insights into the behaviour of the alloy. In this paper the experimental procedures will be described and the results related to the observed behaviour of the alloy in production soldering processes.