

A Comparison of Surface Tension, Viscosity and Density of Sn and Sn-Ag Alloys using Two Measurement Techniques

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Vigorous efforts have been underway to replace lead in the solders used in consumer electronics. Tin-silver is a candidate alloy system to replace the traditional Sn-Pb for these solder applications. Solders must exhibit a vast range of important properties for their application to the product and for their performance in service. For the former, a measure of the surface tension and viscosity of the alloy is needed. In this work a collaborative effort was initiated and will be described to make these property measurements on Sn and Sn-Ag alloys with 3.8, 32, 55.4 and 68.1 atomic % Ag over a temperature range. Thus, the surface tension was measured using the maximum bubble pressure method and the density was obtained with dilatometric technique [1]. The capillary method [2] was used to measure viscosity based on laminar flow in pipes in the Hagen-Poiseuille Law. These results are compared with those obtained using a new method [3] to dynamically measure these properties for a fluid by means of it draining from a crucible under the influence of gravity. A comparison of all these results will be used to extend the SURDAT data base [4].

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[3] S.J. Roach and H. Henein, A new method to dynamically measure the surface tension, viscosity and density of melts, *Metallurgical and Materials Transaction B*, 36B, 2005, p.667-676.

[4] Z. Moser, W. Gaşior, A. Dębski, J. Pstruś, Database of lead-free soldering materials, Institute of Metallurgy and Materials Science, PAS, ISBN 83-60768-01-3, Kraków 2007.