

A note on the Spreading Characteristics of some Tin-Lead Solders on Cast Iron

By K. S. RAMAN*

Spreading characteristics of Sn, Pb and nine Sn-Pb alloys on cast iron (3.2% C) have been evaluated by employing zinc ammonium chloride flux (79 parts of zinc chloride and 21 parts of ammonium chloride) at the liquidus temperatures of the solders. The solder, flux and specimen preparation procedures have been reported elsewhere¹. The solder-flux interfacial tension has been determined by the method of Chalmers and Wadie² and contact angles were measured by an optical method². The spreading coefficients³ have been computed by using contact angle and interfacial tension values.

In the figure, contact angle values of tin, lead and Sn-Pb alloys on cast iron at the respective liquidus temperatures with zinc ammonium chloride flux and the corresponding spreading coefficient values have been plotted. The results show that pure metals have better spreading characteristics when compared to the Sn-Pb alloys. For the purpose of comparison, the spreading data for the solders with the chloride flux and at the liquidus temperatures have also been included for 99.99 copper⁴, 60Cu-40Zn brass¹ and 0.15%C steel⁵ bases in the figure. For copper, brass and mild steel, the pure metals have lower spreading values when compared with their alloys. Exactly the opposite trend is noticed in the case of cast iron base. Considering the microstructures of these base metals and especially when carbon steel results are compared with that of cast iron, the peculiar spreading behaviour of Sn-Pb solders on cast iron can be attributed to the presence of graphite flakes. It is also interesting to note from the figure that the nature of variation of spreading coefficient for cast iron is similar to the variation of liquidus temperatures of the different alloys. In the light of this and the results of Eustathopoulos and co-workers⁶, demonstrating the influence of temperature on the contact angle values of Al on carbon, it can be stated that the temperature influences the spreading efficiency of solders even in presence of a non-metallic phase.

It is concluded that graphite flakes in cast iron markedly influence the spreading characteristics of Sn-Pb solders with the zinc ammonium chloride flux.

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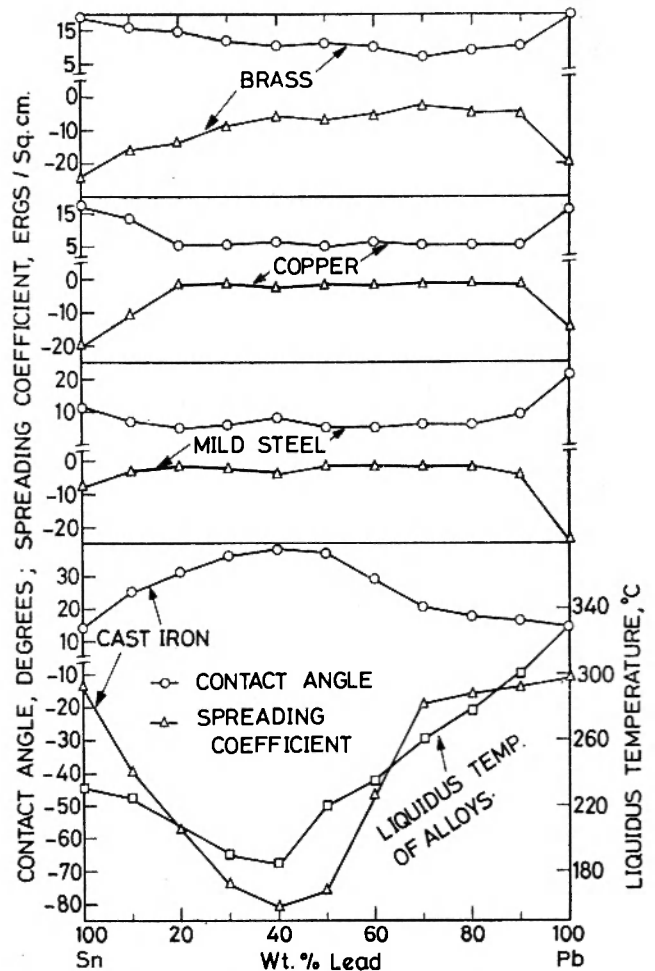


Fig.1. SPREADING PROPERTIES OF Sn-Pb SOLDERS ON DIFFERENT BASES WITH ZINC AMMONIUM CHLORIDE FLUX AT LIQUIDUS TEMPERATURES.

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