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Properties That are Important in Lead-Free Solders

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Abstract

The change to lead-free solders has forced the electronics industry to consider more than it ever has before what properties are important in a solder. When the tin-lead eutectic was the only solder considered in most applications it was a matter of adapting products and processes to the properties of that alloy, taking advantage of its strengths and designing around its weaknesses. With what seemed like an almost unlimited range of options the electronics industry faced a dilemma when it had to choose a lead-free solder to replace the tin-lead solder that it had relied on ever since there was an electronics industry. The initial concern was melting point as it was considered essential that the replacement alloy have a melting point as close as possible to the 183°C of the tin-lead eutectic. It has since been found that higher melting point alloys can be used without a *pro rata* increase in process temperature. The higher yield point of most lead-free solder options seemed initially to be a bonus but it has subsequently been realised that in some circumstances compliance is more important than strength. Although some properties of tin-lead solder have turned out to be not as essential in a lead-free solder as initially expected other properties are turning out to be as important in a lead-free as they were in tin-lead. Solidification behaviour and fluidity are two examples of such properties and it has been found that lead-free solders that match tin-lead solder in that regard offer measurable performance advantages. In this paper the authors will review the solder properties they consider important in a lead-free solder and report the results of measurement of these properties in a range of lead-free solders currently used or under consideration for commercial production.