

SALT: Soldering Aluminium at Low Temperature

C. Van Veen

Mat-Tech BV, Ekkersrijt 4605, 5692DR, Son, The Netherlands

Challenges and objectives

Joining of Aluminium and its alloys represents a specific challenge due to the presence of the tenacious oxide film at the metal surface.

Successful joining of any Aluminium alloy requires a surface modification action, leading to removal of the native surface oxide film, which can be done through mechanical abrasion or chemical etching or photon absorption.

The surface modification action must be capable of displacing the oxide film barrier during joining, stabilization of the obtained surface, prevent the alloy surface from re-oxidizing, and allow the solder metal to flow freely to form the desired joint shape.

Normally in industry Aluminium parts are joined through brazing using near-eutectic AlSi filler at temperatures around 600 °C . Various aluminum alloys have different solderability: the 1xxx, 2xxx, 3xxx, 4xxx, and 7xxx series are easier to solder than the 5xxx and 6xxx series alloys.

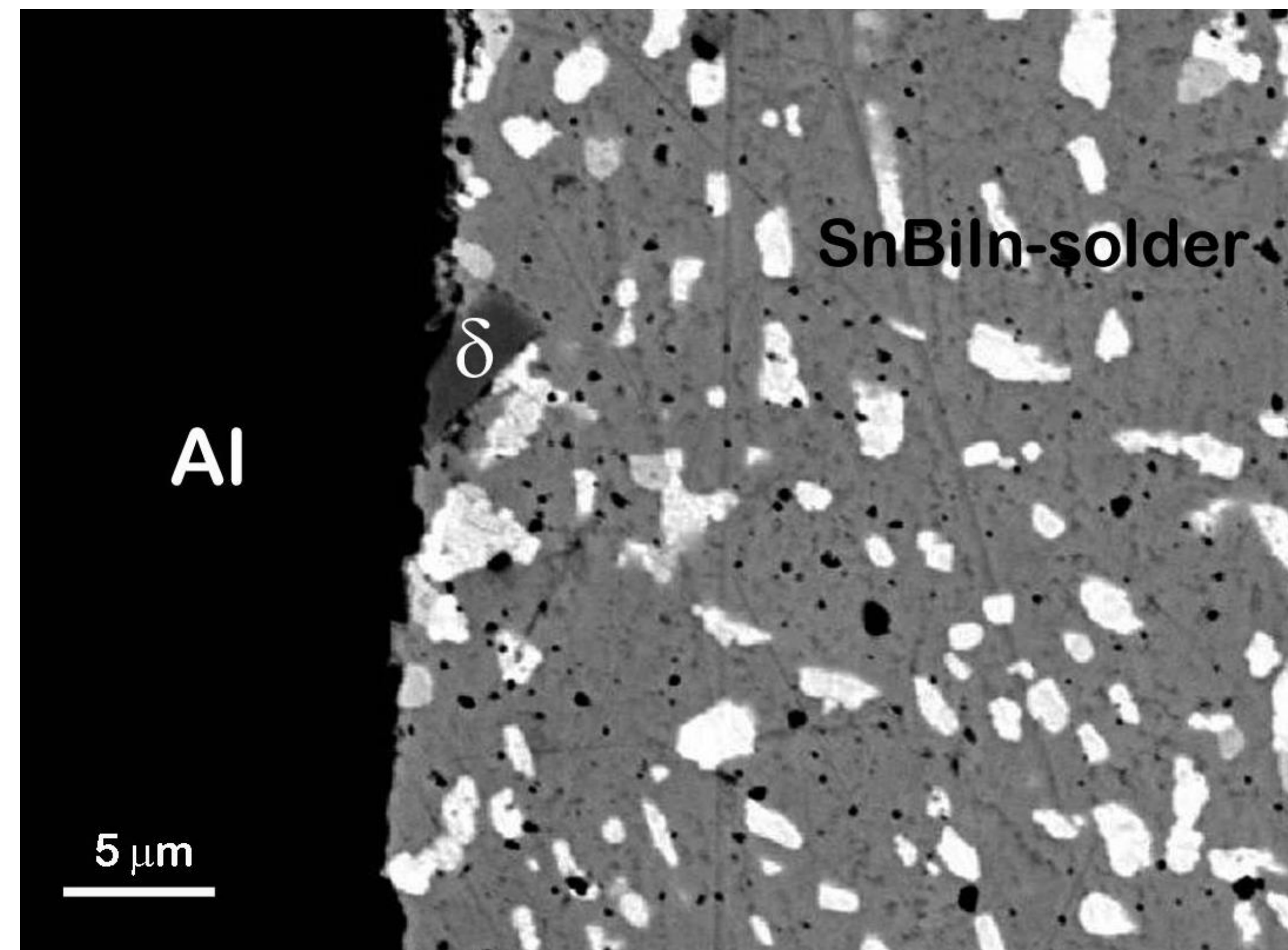
It is the objective of the SALT project to develop a Pb-free joining technology for local soldering aluminium components with a suitable low temperature solder. Low temperature is defined as soldering below 300 °C.

Technical goals

- Local removal of oxides through chemical etching or mechanical abrasion or laser ablation
- Stabilisation through working in a protective ambient or under a liquid
- Render Aluminium solderable through local modification of the surface of the Al-alloy, e.g. through less Ni(P) plating or Ni electroplating or an alternative
- Local heating through a strongly focused light /laser source
- Deposition of the solder through a solder deposition equipment (yet to be defined)

Expected impact

- Products that can be realized through the new technology, range from the small RF ID tags to large interconnect in light to electricity converting devices
- Aluminium is a low cost environmentally compliant metal, fitting well within the circular economy
- Aluminium is environmentally stable in the sense that it does corrode over time
- Soft soldering below 300 °C requires far less energy than brazing at 600 °C.



Back-scattered electron image of the Al-substrate/SnBiIn(Ag)-solder interface. The formation of the δ -phase during soldering procedure is clearly visible