

# Al-Bi-Sn (Aluminum-Bismuth-Tin)

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Ternary alloys having a four-phase monotectic reaction can possess interesting properties, with two different solidified liquids in the microstructure. In their search for monotectic aluminum alloys, [2005Gro] computed the liquidus surface of this ternary system.

## Binary Systems

The Al-Bi phase diagram depicts a liquid miscibility gap with the critical temperature at 1037 °C. A monotectic reaction occurs at 658 °C, where an Al-rich liquid  $L_1$  decomposes to (Al) and a Bi-rich liquid  $L_2$ . The final solidification is at the Bi-end through the eutectic reaction at 270 °C:  $L_2 \leftrightarrow (\text{Al}) + (\text{Bi})$ . The Al-Sn phase diagram is of the simple eutectic type, with the eutectic reaction at 228 °C and 97.6 at.% Sn. The shape of the liquidus curve suggests the presence of a metastable liquid miscibility gap in the Al-Sn system. The Bi-Sn system is of the simple eutectic type, with the eutectic reaction at 139 °C and 43 at.% Bi. See [Massalski2] for the above phase diagrams.

## Liquidus Projection

In their thermodynamic calculation, [2005Gro] employed the binary interaction parameters from the published literature. The liquidus projection shown in Fig. 1 was computed by extrapolation of the binary data, without introducing any new parameters. The liquid miscibility gap originating from the Al-Bi side closes within the ternary region. The eutectic univariant lines from the Al-Sn and Al-Bi sides descend

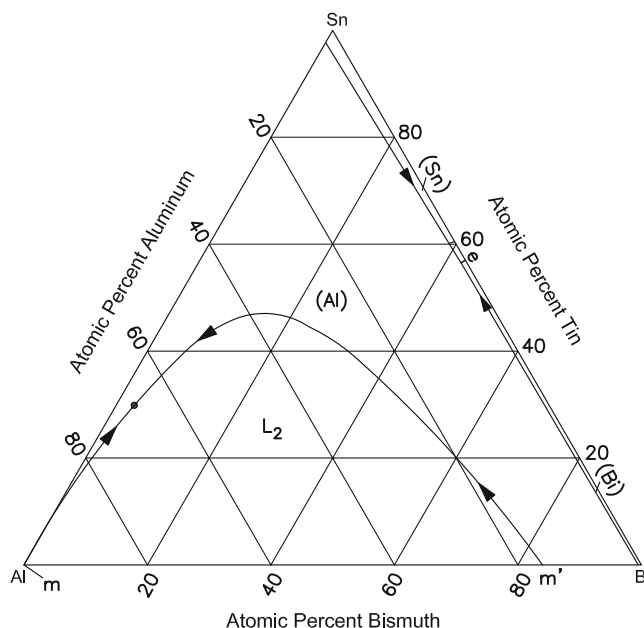


Fig. 1 Al-Bi-Sn computed liquidus projection [2005Gro]

towards each other, with a four-phase invariant reaction close to the eutectic point of the Bi-Sn system.

## References

- 2005Gro: J. Grobner and R. Schmid-Fetzer, Phase Transformations in Ternary Monotectic Aluminum Alloys, *JOM*, 2005, 57(9), p 19-23