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Al-Sb-Si (Aluminum-Antimony-Silicon)

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Antimony added in small amounts to eutectic Al-Si alloys acts as a modifier, refining the eutectic structure and improving the mechanical properties of Al-Si castings. The compilation of the phase relationships in this ternary system by [1995Vil] presented a partial liquidus projection for Al rich alloys, a pseudobinary section along the AlSb-Si join and three vertical sections at 3, 6 and 10 mass% Sb respectively. More recently, [2000Han] computed the phase equilibria of this ternary system.

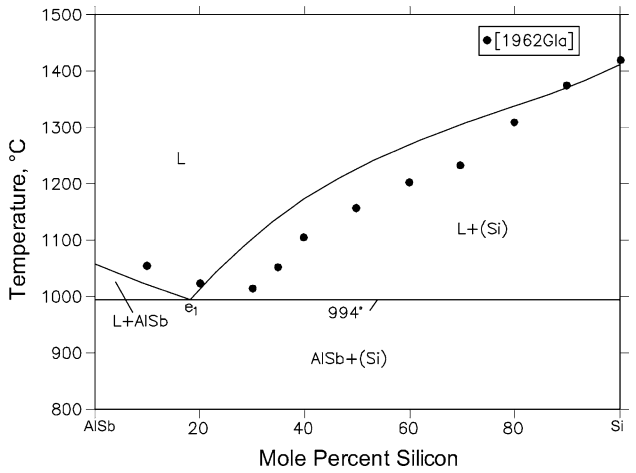

Fig. 1 Al-Sb-Si computed pseudobinary section along AlSb-Si join [2000Han]

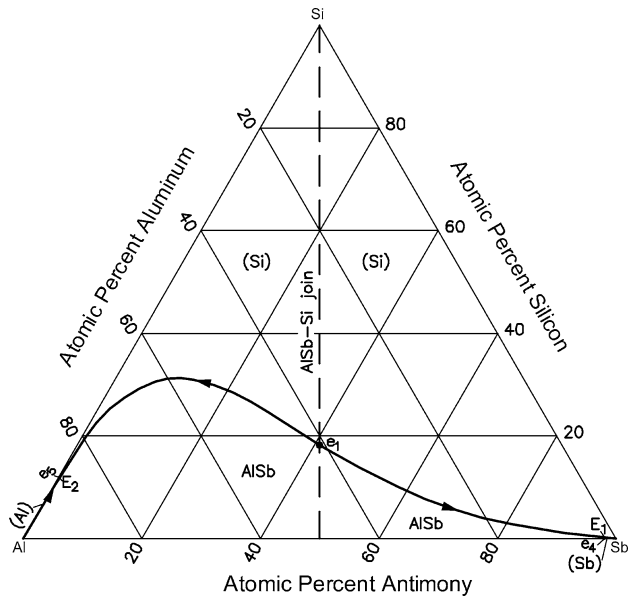

Fig. 2 Al-Sb-Si computed liquidus projection [2000Han]

Binary Systems

The Al-Sb phase diagram contains a stoichiometric compound AlSb, which melts congruently at 1058 °C. Eutectic solidification occurs on either side of this

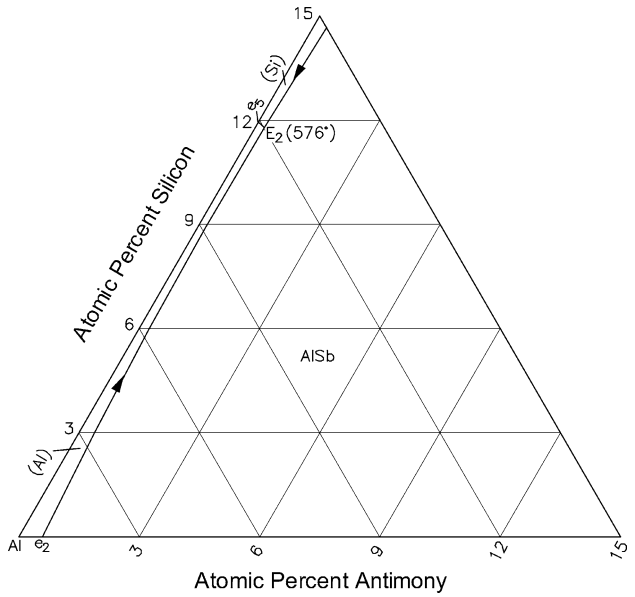

Fig. 3 Al-Sb-Si enlarged view of the Al-rich region of Fig. 2 [2000Han]

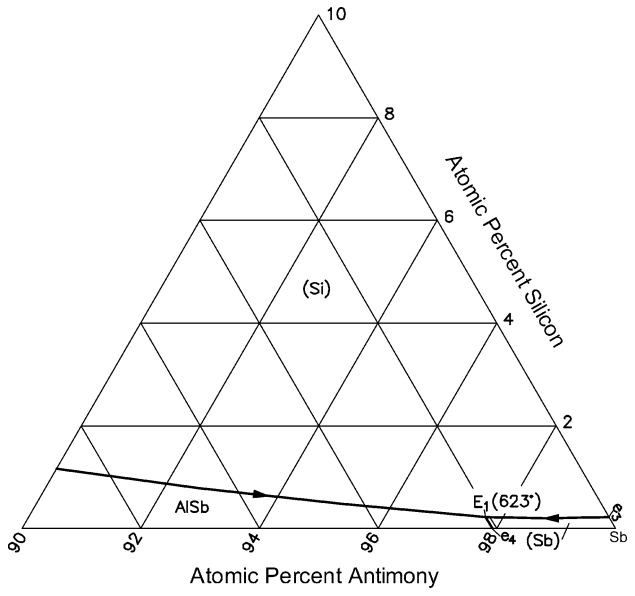

Fig. 4 Al-Sb-Si enlarged view of the Sb-rich region of Fig. 2 [2000Han]

compound, with little terminal solubility in Al or Sb. The Al-Si phase diagram is a simple eutectic system, with the eutectic at 11.8 at.% Si and at 577 °C. The Sb-Si system is of the simple eutectic type, with the eutectic at 99.8 at.% Sb and at 630 °C. Computed phase diagrams of the above binary systems were given by [2000Han].

Computed Ternary Phase Equilibria

[2000Han] used the thermodynamic descriptions of the binary systems from the literature with minor modifications. No ternary interaction parameters were introduced. The computed pseudobinary section along the AlSb-Si join is compared with the experimental data of [1962Gla] in Fig. 1. The computed eutectic is at 18.2 at.% Si and at 994 °C, whereas the data of [1962Gla] give the eutectic at 30 at.% Si and 1014 °C. The computed liquidus projection is shown in Fig. 2. Details at the Al and Sb corners are shown in Fig. 3 and 4 respectively. The univariant line starting at the eutectic maximum on the AlSb-Si join descends to the ternary eutectic point on either side. At the Al end, the reaction E_2 occurs at 576 °C: $L \leftrightarrow$ (Al) + AlSb + (Si). At the Sb end, E_1 occurs at 623 °C: $L \leftrightarrow$ (Sb) + AlSb + (Si) [2000Han].

References

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