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Al-Mg-Sb (Aluminum-Magnesium-Antimony)

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The early work on this ternary system was compiled by [1995Vil]. Recently, [2005Bal] optimized the thermodynamic parameters of the Al-Sb and Mg-Sb binary systems and combined the same with the well-established description of the Al-Mg system to calculate a liquidus projection and two vertical sections.

Binary Systems

The Al-Mg phase diagram [1998Lia] has the following intermediate phases: Mg_2Al_3 (cubic, labeled β), R or ε (rhombohedral), and $Mg_{17}Al_{12}$ (*A*12, αMn-type cubic, denoted γ). The phase diagram data and the thermochemical properties of the Al-Sb and Mg-Sb systems were reviewed in detail by [2005Bal]. The phase diagrams computed by [2005Bal] using the optimized interaction parameters agree well with the literature data. The Al-Sb system has one congruently melting stoichiometric compound AlSb (*B*3, ZnS-sphalerite type cubic, melting point 1055 °C). On either side of AlSb, eutectic reactions $L \leftrightarrow (Al) + AlSb$ and $L \leftrightarrow AlSb + (Sb)$ occur at 658 and 620 °C, respectively. The Mg-Sb system has one intermediate phase Mg_3Sb_2 with two crystal modifications: βMg_3Sb_2 ($D5_3$, βMn_2O_3-type cubic) and αMg_3Sb_2 ($D5_2$, La_2O_3-type hexagonal). On either side of Mg_3Sb_2, eutectic reactions $L \leftrightarrow (Mg) + \alpha Mg_3Sb_2$ and $L \leftrightarrow \alpha Mg_3Sb_2 + (Sb)$ occur at 629 and 581 °C, respectively.

Computed Ternary Phase Equilibria

Combining their optimized interaction parameters for the Al-Sb and Mg-Sb systems with the literature description of the Al-Mg system [1998Lia], [2005Bal] calculated the ternary phase equilibria, without introducing any ternary parameters. The liquidus projection computed by [2005Bal] is shown in Fig. 1. The temperatures and the compositions of the participating phases in the invariant reactions were listed by [2005Bal]. The closed loop formed by the liquidus lines in Fig. 1 is qualitatively consistent with the closed liquid miscibility gap reported in the early literature, see [1995Vil]. Along the Al-Mg side, a liquidus line runs just below the miscibility gap from the Mg end to the (Al) corner. Phases of primary crystallization are marked in Fig. 1. Two of the invariant reactions on the liquiudus

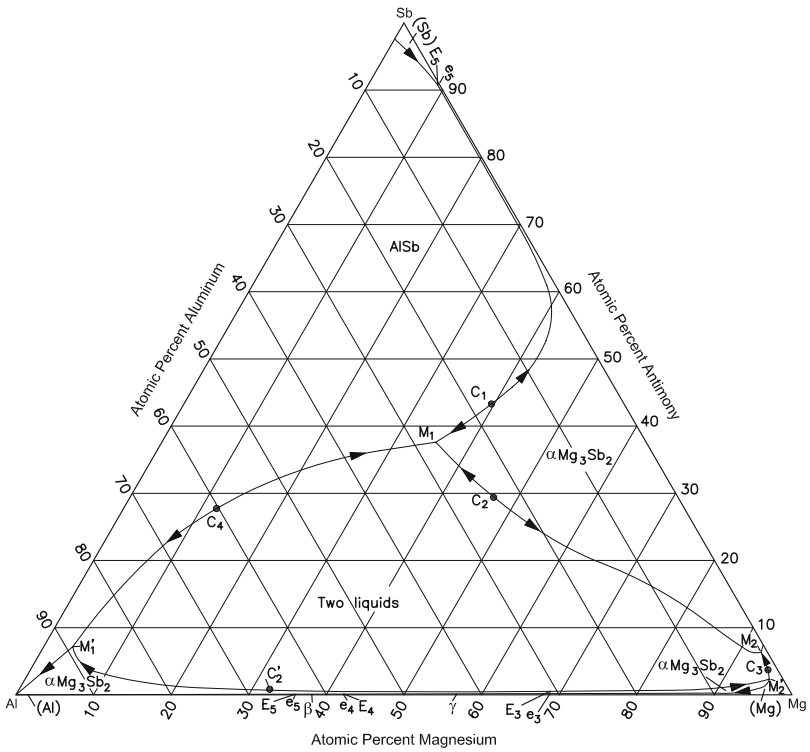

Fig. 1 Al-Mg-Sb computed liquidus projection [2005Bal]

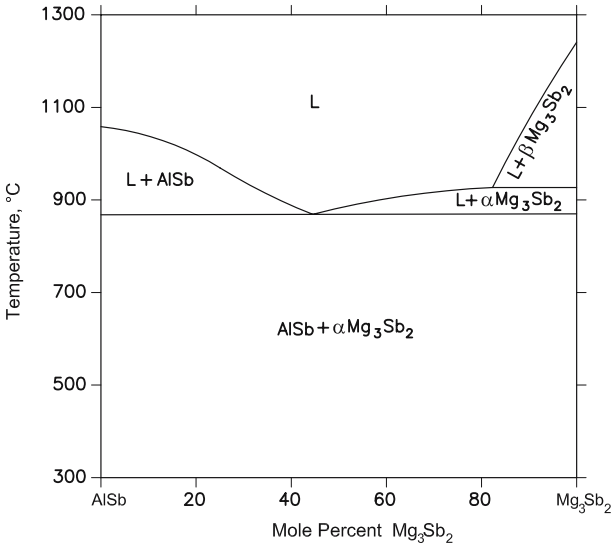

Fig. 2 Al-Mg-Sb computed pseudobinary section along the AlSb-Mg_3Sb_2 join [2005Bal]

surface in Fig. 1 have been redesignated here as ternary monotectic reactions M_1 and M_2. The computed liquid miscibility gap disappears at 1112 °C. Computed vertical sections along the AlSb-Mg_3Sb_2 and Al-Mg_3Sb_2 joins are shown in Fig. 2 and 3 [2005Bal]. No experimental data are available for comparison.

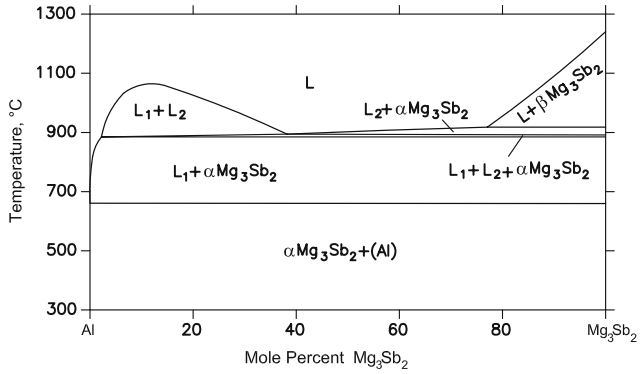

Fig. 3 Al-Mg-Sb computed vertical section along the Al-Mg_3Sb_2 join [2005Bal]

References

1995Vil: P. Villars, A. Prince, and H. Okamoto, Al-Mg-Sb, *Handbook of Ternary Alloy Phase Diagrams*, ASM International, Materials Park, OH, 1995, Vol 4, p 3899-3901

1998Lia: P. Liang, H.L. Su, P. Donnadieu, M. Harmelin, A. Quivy, P. Ochin, G. Effenberg, H.J. Seifert, H.L. Lukas, and F. Aldinger, Experimental Investigation and Thermodynamic Calculation of the Central Part of the Mg-Al Phase Diagram, *Z. Metallkd.*, 1998, **89**(8), p 536-540

2005Bal: T. Balakumar and M. Medraj, Thermodynamic Modeling of the Mg-Al-Sb System, *CALPHAD*, 2005, **29**, p 24-36