

Al-Be-Si (Aluminum-Beryllium-Silicon)

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The early literature on this ternary system was reviewed by [1990Sti] and [1995Vil], based mainly on the studies of [1931Mas], [1946Now], and [1972Nis]. Recently, [2005Pan] reported new experimental results and a thermodynamic assessment. A liquidus projection was computed. Calculated vertical sections were compared with the new and old experimental data.

Binary Systems

The Al-Be, Al-Si, and Be-Si phase diagrams are all of the simple eutectic type. [2005Pan] computed the Be-Si phase diagram and compared it with the published experimental data. [2005Pan] also presented calculated diagrams from [1996Gro] (Al-Si) and [2004Pan] (Al-Be).

Ternary Phase Equilibria

With starting metals of 99.999% Al, 99.8% Be, and 99.999% Si, [2005Pan] arc-melted 11 ternary alloys under Ar atm. The alloy samples were annealed at 530 °C for 8 days and quenched in water. The phase equilibria were studied by optical and electron metallography, x-ray diffraction, and differential thermal analysis at a heating/cooling rate of 5 °C per min. The liquid phase, (Al), (α Be), (β Be), and (Si) were modeled as substitutional solutions. The interaction parameters optimized by [1996Gro] for Al-Si and by [2004Pan] for Al-Be were accepted by [2005Pan]. The parameters for the Be-Si system were obtained through their own optimization. No ternary interaction parameters were found necessary. Four

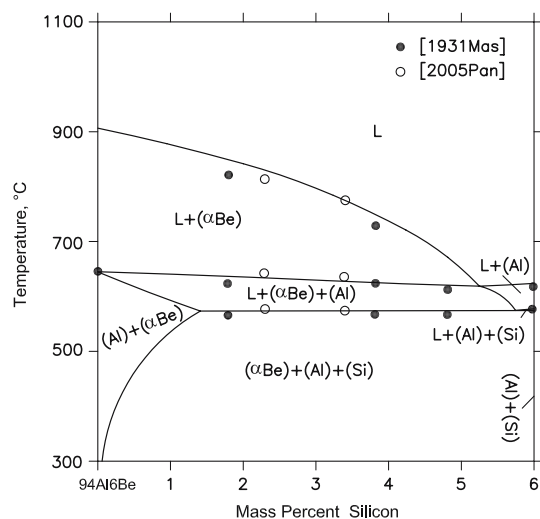


Fig. 1 Al-Be-Si computed vertical section at 94 mass% Al [2005Pan]

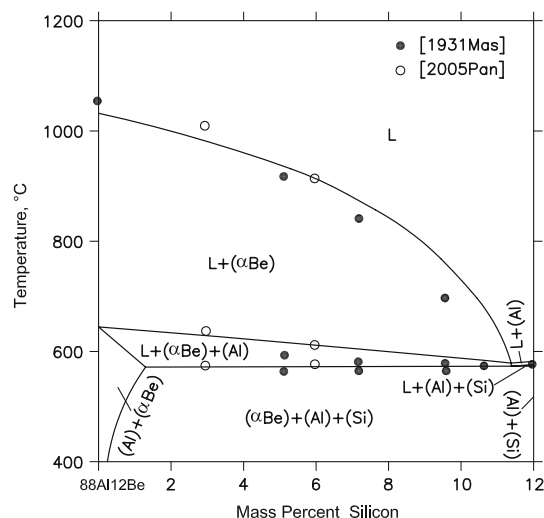


Fig. 2 Al-Be-Si computed vertical section at 88 mass% Al [2005Pan]

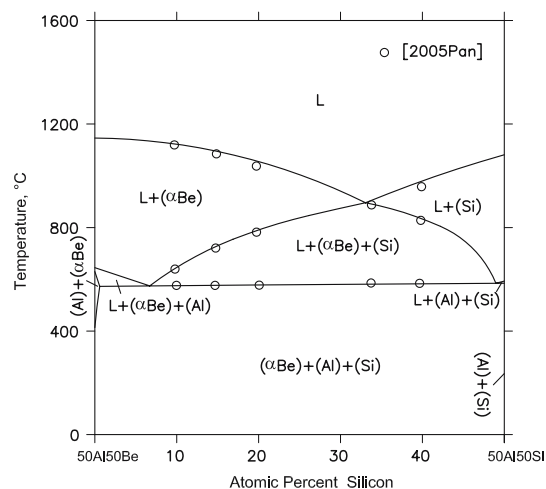


Fig. 3 Al-Be-Si computed vertical section at 50 at.% Al [2005Pan]

vertical sections at 94 mass% Al, 88 mass% Al, 50 at.% Al, and 2 mass% Be, respectively, were calculated and compared with experimental data, as shown in Figs. 1-4. The liquidus projection computed by [2005Pan] is shown in Fig. 5. The final solidification is through a ternary eutectic reaction E: $L \leftrightarrow (Al) + (\alpha Be) + (Si)$. The computed temperature of the eutectic reaction is 571 °C, in good agreement with most of the experimental results in the literature. The computed composition of the eutectic liquid is 1.6 at.% Be and 11.8 at.% Si, which agrees only with the results of

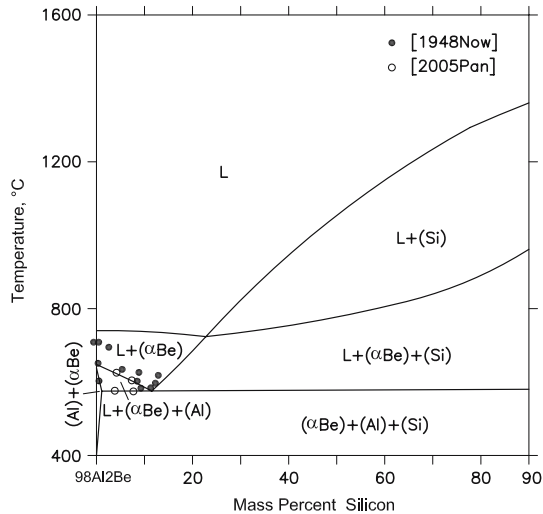


Fig. 4 Al-Be-Si computed vertical section at 2 mass% Be [2005Pan]

[1972Nis]. The computed composition of the (Al) solid solution at the eutectic equilibrium is 0.06 at.% Be and 1.4 at.% Si.

References

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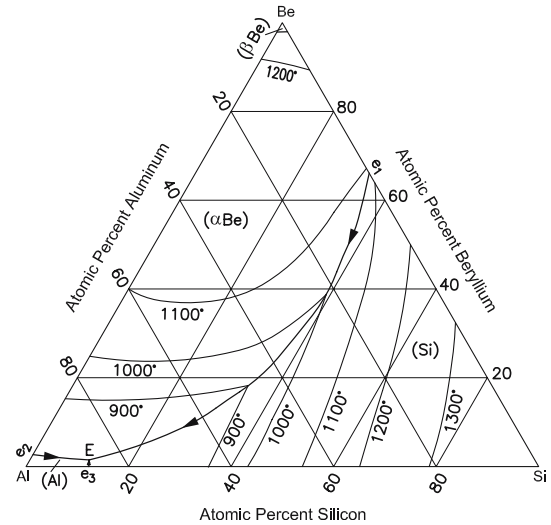


Fig. 5 Al-Be-Si computed liquidus projection [2005Pan]