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Al-Pb-Sn (Aluminum-Lead-Tin)

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This ternary system is characterized by the extension of the Al-Pb liquid miscibility gap into the ternary region up to high Sn contents. The recent experimental work and thermodynamic assessment of [2001Shi] confirms the early work by [1953Dav] and [1956Cam] on the miscibility gap.

Binary Systems

The Al-Pb binary system [2001Shi] depicts a large liquid miscibility gap that closes at ~1430 °C, with a monotectic reaction at the Al-end at ~660 °C. The Al-Sn phase diagram is a simple eutectic system with the eutectic composition and temperature at 97.6 at.% Sn and 228 °C. The Pb-Sn system is also a simple eutectic system with the eutectic reaction at 73.9 at.% Sn and 183 °C.

Ternary Phase Equilibria

With starting metals of purity greater than 99.9%, [2001Shi] melted alloy compositions that lie in the liquid immiscibility region. The melts were held for 12 h between 913 and 680 °C for the Al-Pb binary alloys and between 1020 and 800 °C for the ternary alloys. The composition of the quenched melts was analyzed with atomic absorption and inductively-coupled plasma spectrometry. The compositions of the coexisting liquids were listed both for binary and ternary alloys.

A regular solution model was used for describing the liquid, face-centered cubic and body-centered tetragonal phases. The newly-derived ternary interaction parameter for the liquid phase was listed. The liquid miscibility gap was computed at 1020, 950, 895, 842, 800, 730, and 650 °C by [2001Shi] and compared with their own experimental results and those of [1953Dav]. The agreement between experiments and calculations was found to be satisfactory. Here, the isothermal sections depicting the liquid miscibility gap at 950, 800, and 650 °C are shown in Fig. 1-3. [2001Shi] computed two more isothermal sections at 600 and 500 °C, where the (Al) solid solution in equilibrium with the liquid and compared them with the experimental results of [1956Cam]. The isothermal section at 600 °C is shown in Fig. 4.

References

1953Dav: M.H. Davies, The Liquid Immiscibility Region in the Aluminum-Lead-Tin System at 650, 730 an 800 °C, *J. Inst. Metals (London)*, 1953, **81**, p 415-416

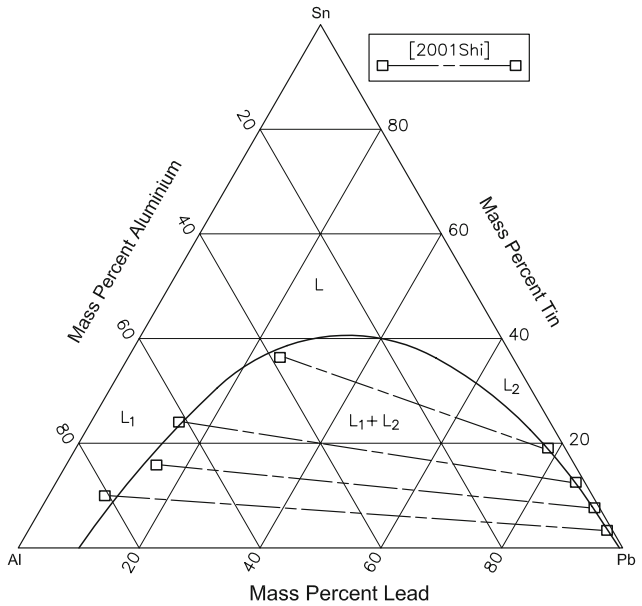

Fig. 1 Al-Pb-Sn computed isothermal section at 950 °C [2001Shi]

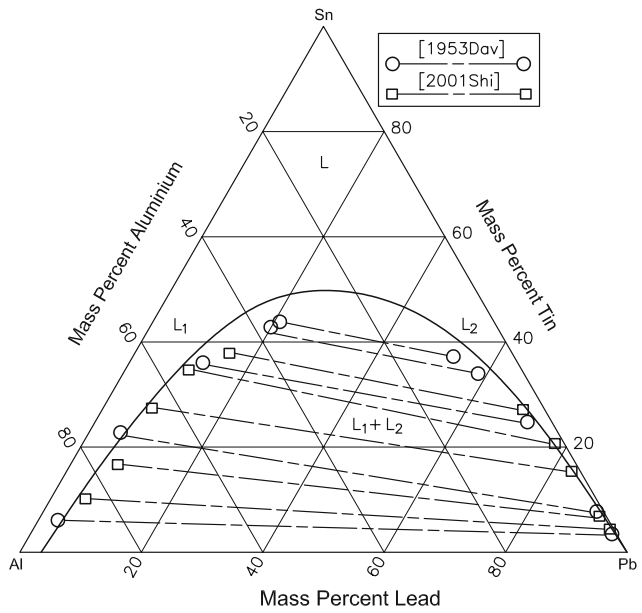

Fig. 2 Al-Pb-Sn computed isothermal section at 800 °C [2001Shi]

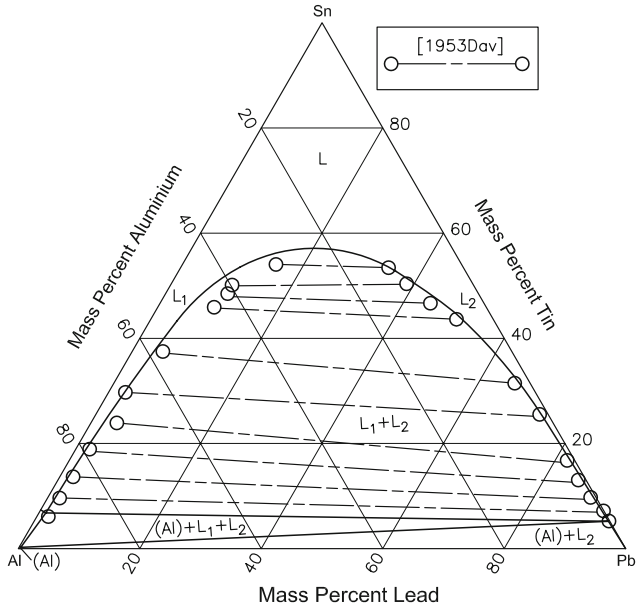

Fig. 3 Al-Pb-Sn computed isothermal section at 650 °C [2001Shi]

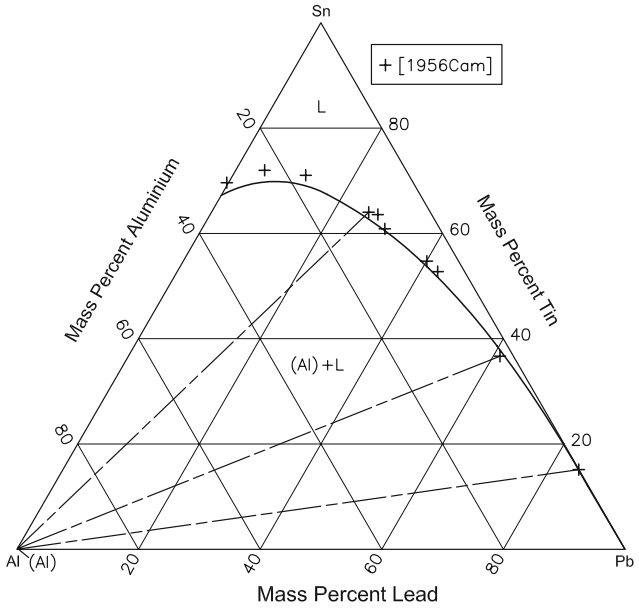

Fig. 4 Al-Pb-Sn computed isothermal section at 600 °C [2001Shi]

1956Cam: A.N. Campbell and R. Kartzmark, The Systems Aluminum-Tin and Aluminum-Lead-Tin, *Can. J. Chem.*, 1956, **34**, p 1428-1439

2001Shi: J.H. Shim, H.N. Lee, H.P. Ha, Y.W. Cho, and E.P. Yoon, Liquid Miscibility Gap in the Al-Pb-Sn System, *J. Alloys Compd.*, 2001, **327**, p 270-274