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Al-Ge-Mg (Aluminum-Germanium-Magnesium)

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Recently, [2006Isl] presented a thermodynamic description of this ternary system and computed a liquidus projection and several vertical sections, which were compared with experimental data.

Binary Systems

The Al-Ge phase diagram [2006Isl] is a simple eutectic system, with the eutectic temperature and composition at 425 °C and 27.3 at.% Ge. The Al-Mg phase diagram [1998Lia] has the following intermediate phases: Mg_2Al_3 (cubic, labeled β), ε or R (rhombohedral), and $Mg_{17}Al_{12}$ (*A*12, α Mn-type cubic, denoted γ). In the Ge-Mg system [2006Isl], a line compound Mg_2Ge (*C*1, CaF_2-type cubic) is found, with the eutectic-type solidification on either side of this stoichiometric composition.

Ternary Phase Equilibria

For the Al-Ge and Ge-Mg binary systems, [2006Isl] carried out a thermodynamic optimization, using the

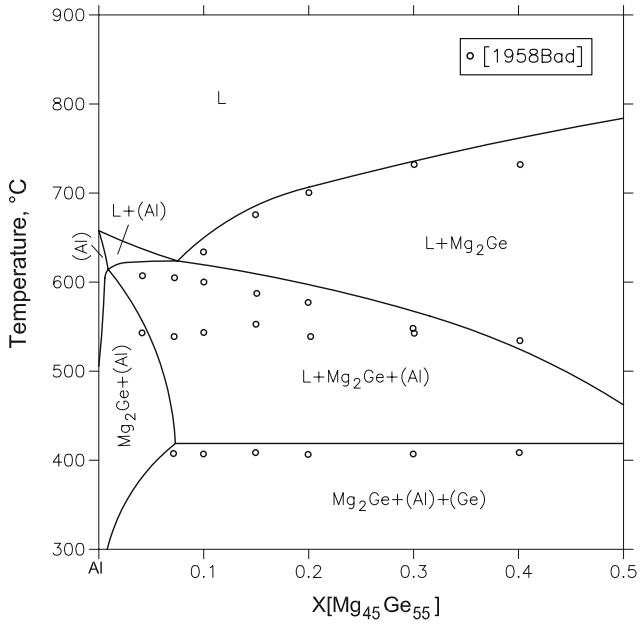

Fig. 2 Al-Ge-Mg vertical section along the Al-$Mg_{45}Ge_{55}$ join [2006Isl]

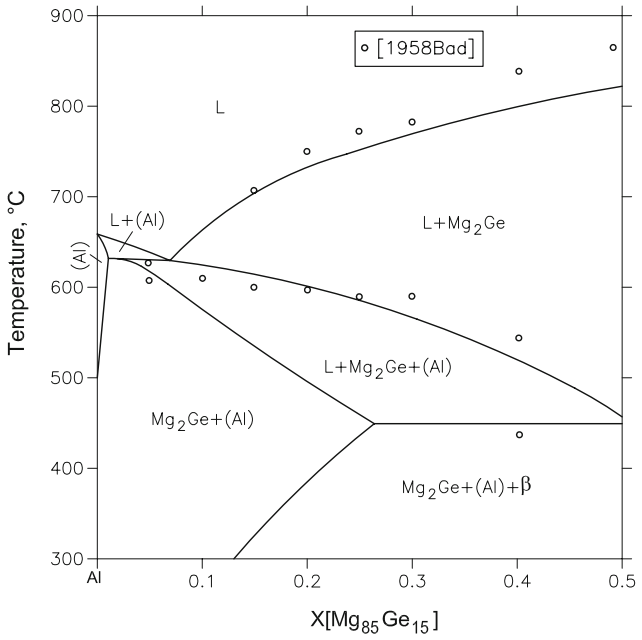

Fig. 1 Al-Ge-Mg vertical section along the Al-$Mg_{85}Ge_{15}$ join [2006Isl]

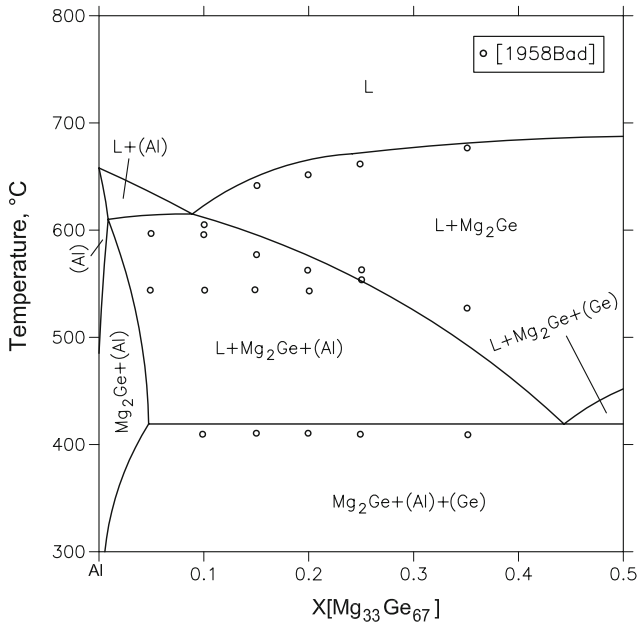

Fig. 3 Al-Ge-Mg vertical section along the Al-$Mg_{33}Ge_{67}$ join [2006Isl]

published literature data on phase equilibria and thermodynamic measurements. The computed phase diagram and thermodynamic properties showed good agreement with the experimental data. For the Al-Mg phase diagram, a description based on the experimental data of [1998Lia] was used. The ternary system was modeled by combining the three binary descriptions, with one additional ternary interaction parameter for the liquid phase. The liquidus projection computed by [2006Isl] shows ternary eutectic solidification near the Al-Ge eutectic point and near the Al-β (Al_3Mg_2) eutectic point, which is in agreement with the experimental liquidus projection for Al-rich alloys given by [1969Sam]. [2006Isl] calculated seven vertical sections in atomic percent scale along the Al-$Mg_{97.77}Ge_{2.33}$, Al-$Mg_{95}Ge_5$, Al-$Mg_{85}Ge_{15}$, Al-$Mg_{75}Ge_{25}$, Al-$Mg_{45}Ge_{55}$, Al-$Mg_{33}Ge_{67}$, and Al-Mg_5Ge_{95} joins respectively. Comparison with the experimental data of [1958Bad] showed the agreement to be good or satisfactory. Here, the vertical sections along the Al-$Mg_{85}Ge_{15}$, Al-$Mg_{45}Ge_{55}$ and Al-$Mg_{33}Ge_{67}$ joins are shown in Fig. 1-3 respectively. Also, [2006Isl] computed two sections along the Al-Mg_2Ge and Al_3Mg_2-Mg_2Ge joins and compared them with the pseudobinary sections experimentally determined by [1958Bad]. The computed sections (not shown here) show three-phase regions and are not pseudobinary.

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