

Al – Ge (Aluminum – Germanium)

Phase diagram

Using microprobe analysis Minamino et al. [91 Min] have determined the solidus and the solvus at the Al-rich side of the system. The results are plotted in Fig. 1. Okamoto [93 Oka] has discussed shortly this system.

Fujikava et al. [93 Fuj] have determined the solid solubility of Ge in Aluminum by resistivity measurements. The values obtained are plotted in Fig. 2.

The solubility of Ge in Aluminum under pressure has been investigated by Soma et al. [90 Som]. The results are given in Fig. 3.

Minamino et al. [91 Min], as mentioned above, have investigated the Al-rich side of the phase diagram. Three isobaric sections were published: at 0.1 MPa, 2.2 GPa and at 2.6 GPa. These sections are redrawn in Fig. 4 to Fig. 6. The Al-phase field is increasing with increasing pressure.

Metastable phase diagram

Non-equilibrium crystallization of Al-Ge melts has been investigated by Laoui et al. [91 Lao]. In the range between 30 and 50 at% Ge four metastable phases were found. Their crystal structures are:

monoclinic (M),
rhombohedral (L)
hexagonal (H)

and orthorhombic (O).

The formation of them is dependent not only on the extent of undercooling of the melt, but also on the presence of suitable nucleation sites. The metastable phases form metastable phase equilibria. These are exclusively equilibria between a metastable phase and α - Al solid solution.

Laoui et al. [91 Lao] have proposed two metastable phase diagrams, one with the metastable phase M (Fig. 7) and another one with the phase R (Fig. 8).

Laoui et al. [91 Lao] pointed out, that analogous metastable phase diagram including an O and a H phase at time could not be drawn due to lack of necessary data.

Crystal structure

Lattice constants of solid solutions have been determined at a pressure of 5.4 GPa by Matsumura et al. [93 Mat]. The results are given in Fig. 9.

Figures

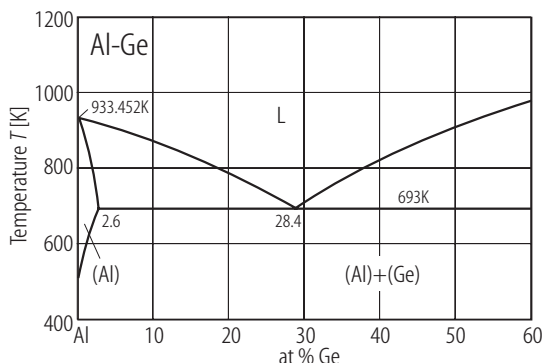


Fig. 1. Al-Ge. Phase equilibria at < 55 at% Ge [91 Min], [93 Oka].

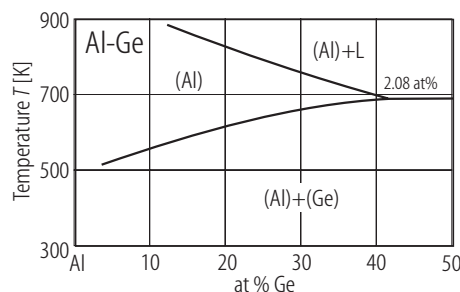


Fig. 2. Al-Ge. Solubility of Ge in (Al) [93 Fuj].

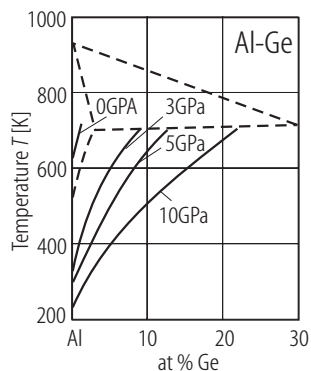


Fig. 3. Al-Ge. Solubility of Ge in (Al) under pressure [90 Som].

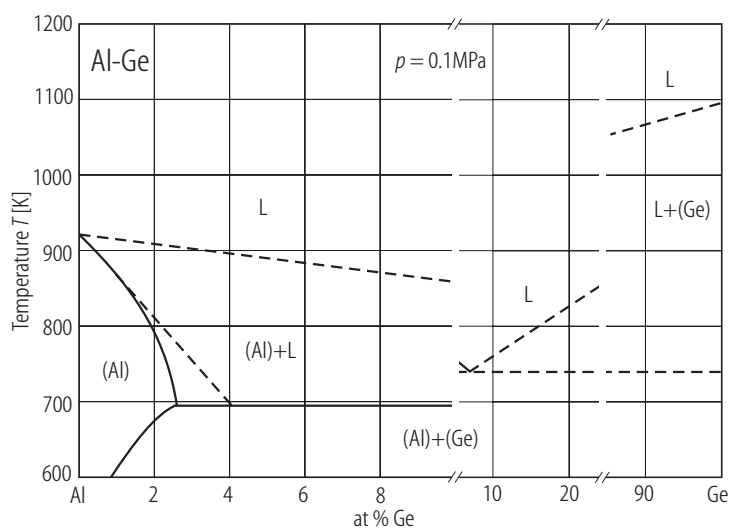


Fig. 4. Al-Ge. Phase equilibria at 0.1 MPa [91 Min]. Solid lines: experimental; dashed lines: calculated.

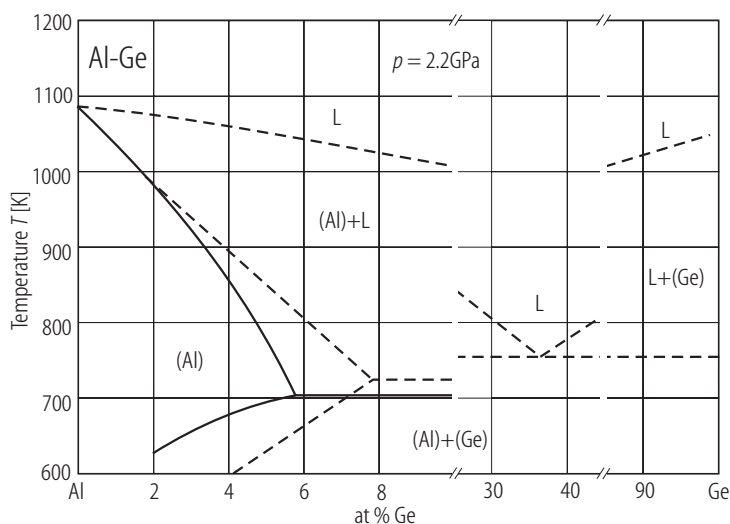


Fig. 5. Al-Ge. Phase equilibria at 2.2 GPa [91 Min]. Solid lines: experimental; dashed lines: calculated.

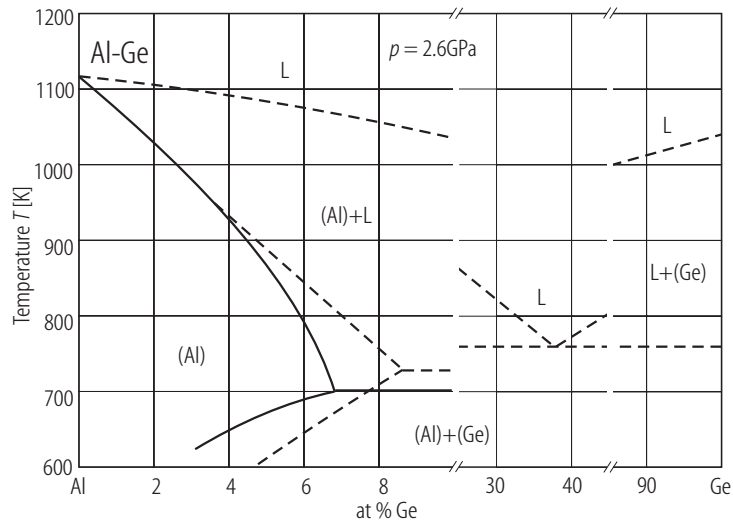


Fig. 6. Al-Ge. Phase equilibria at 2.6 GPa [91 Min]. Solid lines: experimental; dashed lines: calculated.

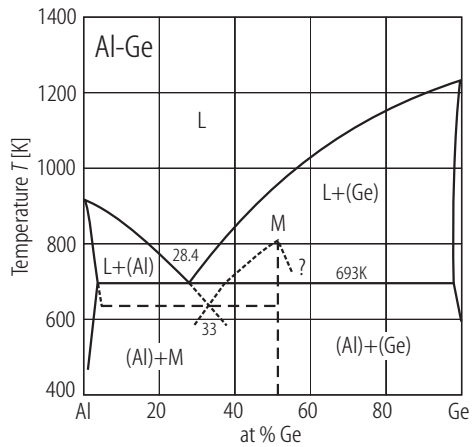


Fig. 7. Al-Ge. Metastable phase equilibria including metastable M phase [91 Lao].

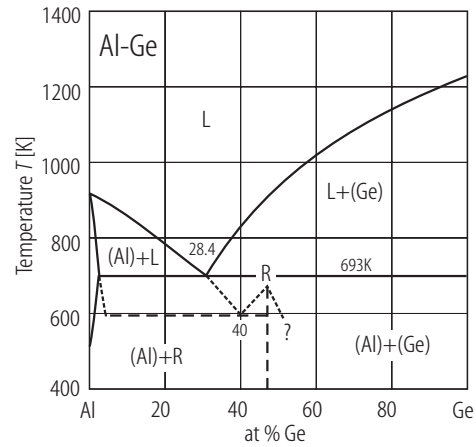


Fig. 8. Al-Ge. Metastable phase equilibria including metastable R phase [91 Lao].

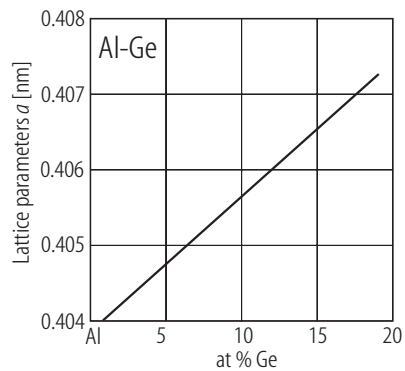


Fig. 9. Al-Ge. Lattice constants of (Al) solid solutions at 5.4 GPa [93 Mat].

References

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