

Al-Mg-Sc-Zn (Aluminum-Magnesium-Scandium-Zinc)

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There are a couple of reports on the phase equilibria in Al-rich alloys of this quaternary system [2001Fri, 2008Rok]. Isothermal sections at a constant Sc content of 0.5 mass% and at 430 and 300 °C were reported by [2008Rok].

Lower Order Systems

Phase diagrams of the relevant binary systems can be found in [Massalski2]. The updates on the previously reviewed Al-Mg-Sc system show an isothermal section at 350 °C, three vertical sections [2007Rag1] and a liquidus projection [2008Rag], all from the computed results of [1999Gro]. The update of [2007Rag2] on the Al-Mg-Zn system reviewed the computed results of [1997Lia] and presented a liquidus projection, an isothermal section at 335 °C and six vertical sections. In the Al-Sc-Zn system (updated in this issue), a ternary eutectic reaction occurs in the Al-rich region at 367 °C, yielding (Al) + (Zn) + ScAl₃.

Quaternary Phase Equilibria

With starting metals of 99.99% Al, 99.96% Mg, 99.86% Sc, and 99.99% Zn, [2008Rok] prepared quaternary alloys containing a constant content of Sc of 0.5 mass% and Mg and Zn contents up to 20 mass%. The alloys were given a final anneal at 430 °C for 100 h or at 300 °C for 200 h, followed by water quenching. The phase equilibria were studied by optical microscopy, x-ray powder diffraction, and electron probe microanalysis. The isothermal sections at 0.5 mass% Sc constructed by [2008Rok] at 430 and 300 °C are shown in Fig. 1 and 2. The phase distribution is similar at the two temperatures, with two four-phase fields of (Al) + ScAl₃ + Mg₂Al₃ + τ and (Al) + ScAl₃ + MgZn₂ + τ. The

solubility of Mg and Zn in ScAl₃ is ~0 and 5 mass%, respectively. The ternary phase τ (Al₂Mg₃Zn₃; cubic *Im* $\bar{3}$) was denoted as T-(Al,Zn)₄₉Mg₃₂ by [2007Rag2]. It showed a wide variation in composition (mass%) from 18.0-16.4 Al, 15.6-18.0 Mg, 66.4-65.6 Zn and 0.03-0.04 Sc at 430 °C to 46.5-45.4 Al, 30.4-30.2 Mg, 23.1-24.4 Zn and 0.01-0.02 Sc at 300 °C [2008Rok]. No quaternary phase was found.

A vertical section at 5.0Mg-0.5Sc (mass%) was constructed by [2001Fri] in the Al-rich region of this quaternary system [2008Rok].

References

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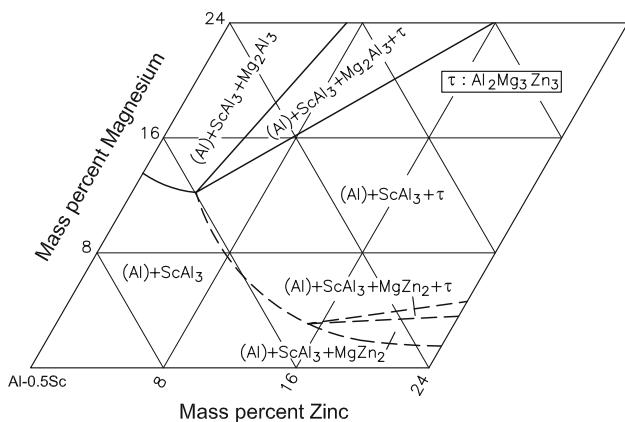


Fig. 1 Al-Mg-Sc-Zn isothermal section at 0.5 mass% Sc and 430 °C [2008Rok]

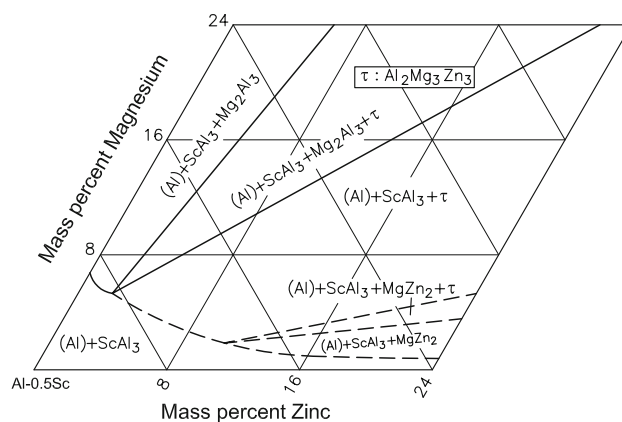


Fig. 2 Al-Mg-Sc-Zn isothermal section at 0.5 mass% Sc and 300 °C [2008Rok]