

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

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A review of the experimental and computed data on this ternary system was reported recently by [2007Rag] and [2006Pet]. The (Mg)-solvus in Mg-rich alloys was recently determined by [2009Ren] at 320 °C.

Binary Systems

The Al-Mg phase diagram has the following intermediate phases: Mg_2Al_3 (denoted β ; cubic, space group $Fd\bar{3}m$), R or ϵ (rhombohedral) and $Mg_{17}Al_{12}$ (denoted γ ; α -Mn type cubic). The Al-Zn phase diagram [Massalski2] contains no intermediate phases. A miscibility gap occurs in the Al-based face centered cubic (fcc) solid solution below 351 °C, where the fcc phase splits into (Al)' and (Al)''. The monotectoid reaction $(Al)'' \leftrightarrow (Al)' + (Zn)$ follows at 277 °C. The Mg-Zn phase diagram [Massalski2] depicts the following intermediate phases: Mg_7Zn_3 (high-temperature phase), $MgZn$, Mg_2Zn_3 (monoclinic), $MgZn_2$ (C14-type hexagonal) and Mg_2Zn_{11} ($D8_c$ -type cubic).

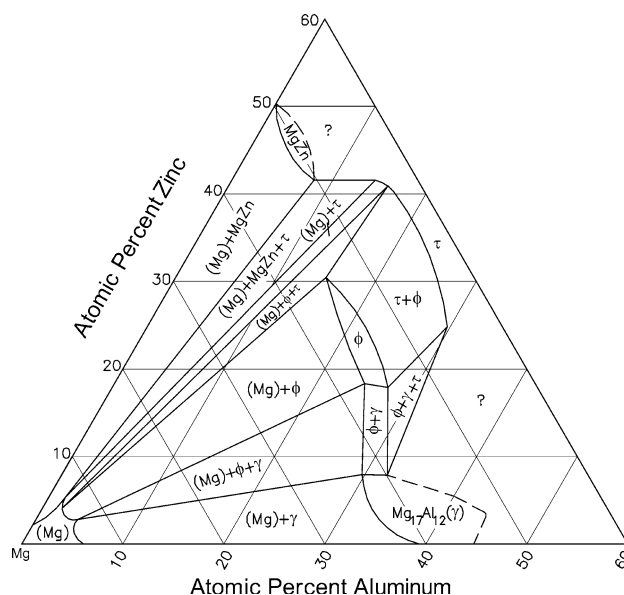


Fig. 1 Al-Mg-Zn isothermal section at 320 °C [2009Ren]

Ternary Phases

Two ternary phases are known in this system. $(Al,Zn)_{49}Mg_{32}$ (denoted τ) is cubic, space group $Im\bar{3}$. $Al_2Mg_5Zn_2$ (denoted ϕ) is orthorhombic and has a range of homogeneity.

Isothermal Section at 320 °C

With starting metals of 99.99% Al, 99.99% Mg and 99.999% Zn, [2009Ren] induction-melted under Ar atm 14 Mg-rich ternary alloys containing up to 33 at.% Al and 40 at.% Zn. The alloys were annealed at 320 °C for 720 h and quenched in water. The phase equilibria were studied with x-ray powder diffraction and scanning electron microscope equipped with energy dispersive x-ray analyzer. The identified phases and their compositions were listed. The partial isothermal section constructed by [2009Ren] at 320 °C is shown in Fig. 1. Figure 2 shows the details at the Mg corner. (Mg) is in equilibrium with both τ and ϕ phases. The homogeneity range of ϕ was found to be 14.7-27 at.% Al and 30.5-17.7 at.% Zn, agreeing with the result of [1997Don] at 335 °C. Aluminum preferentially substitutes for zinc, with the variation in Mg content of ϕ being small (53.7-57 at.%). The maximum solubility of Zn in γ is about 8.3 at.% and that of Al in $MgZn$ is also about 8.3 at.%.

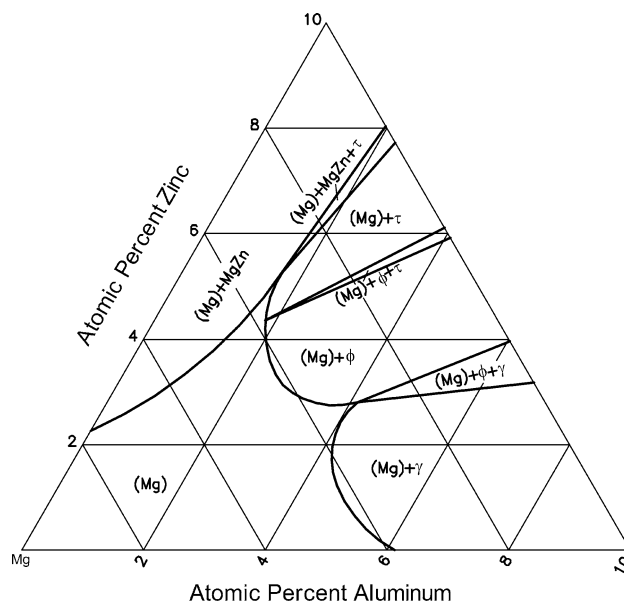


Fig. 2 Al-Mg-Zn isothermal section at 320 °C near the Mg corner [2009Ren]

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Section II: Phase Diagram Evaluations

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