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Al-Ca-Mg-Mn (Aluminum-Calcium-Magnesium-Manganese)

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Recently, [2008Rok] determined two isothermal sections for Mg-rich alloys of this system at 450 and 300 °C at a constant Al content of 1 mass%.

Ternary Subsystems

Updates on the Al-Ca-Mg and Al-Mg-Mn systems were recently reported by [2009Rag1] and [2009Rag2] respectively. The data compiled by [1995Vil] on the Al-Ca-Mn system include a liquidus projection and a partial isothermal section at 500 °C. No data appear to be available on the Ca-Mg-Mn system.

Quaternary Phase Equilibria

With starting metals of 99.99% Al, 99.5+% Ca and 99.96% Mg, [2008Rok] prepared Mg-Ca and Mg-Mn master alloys, which were remelted with Al to make about 40 Mg-rich quaternary alloys containing up to 1.6 mass% Ca and 1.8 mass% Mn and a constant 1.0 mass% Al. The alloys were annealed at 450 °C for 25 h or at 300 °C for 100 h and quenched in water. The phase equilibria were studied with optical microscopy, electron probe microanalysis, electrical resistivity and hardness measurements. The isothermal sections at 450 °C constructed by [2008Rok] at 1 mass% Al is shown in Fig. 1. The Mg-rich solid solution forms tie-lines with (βMn) and Al_2Ca. The three-phase field of (Mg) + (βMn) + Al_2Ca and two four-phase fields of (Mg) + (βMn) + (αMn) + Al_2Ca and (Mg) + (βMn) + Al_2Ca + Mg_2Ca are seen in Fig. 1. The isothermal section at 300 °C (not shown here) has the same phase fields as in Fig. 1, except that the (Mg) + Al_2Ca and (Mg) + (βMn) + Al_2Ca fields are narrower and end at lower Ca levels.

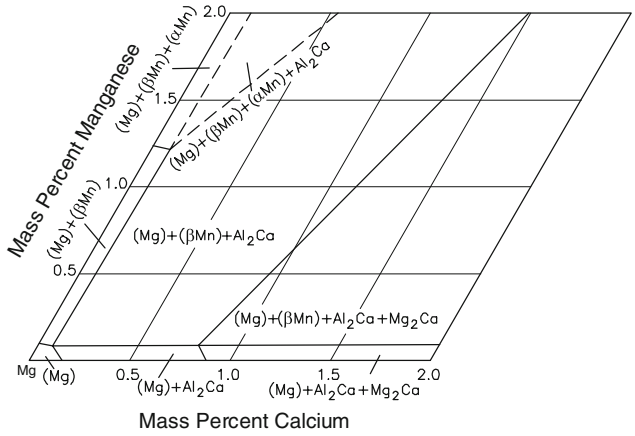

Fig. 1 Al-Ca-Mg-Mn isothermal section for Mg-rich alloys at 450 °C and at 1 mass% Al [2008Rok]

References

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