Al-La-Zr (Aluminum-Lanthanum-Zirconium)

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Recently, [2010Pen] determined an isothermal section for this ternary system at 500 °C, which depicts no ternary phases.

Binary Systems

The Al-La phase diagram [2010Pen, Massalski2] depicts the following intermediate phases: AlLa_3 ($D0_{19}$, Ni_3Sn -type hexagonal), AlLa_2 (tetragonal), Al_4La_5 (space group $P\bar{6}2m$), AlLa (CeAl-type orthorhombic), Al_2La ($C15$, MgCu_2 -type

cubic), Al_7La_3 (stable between 1240 and 1090 °C; $C32$, AlB_2 -type hexagonal), Al_3La (Ni_3Sn -type hexagonal), $\beta\text{Al}_{11}\text{La}_3$ ($D1_3$, Al_4Ba -type tetragonal), and $\alpha\text{Al}_{11}\text{La}_3$ ($\alpha\text{Al}_{11}\text{La}_3$ -type orthorhombic). The Al-Zr phase diagram [Massalski2] depicts the following intermediate phases: Al_3Zr ($D0_{23}$ -type tetragonal), Al_2Zr ($C14$, MgZn_2 -type hexagonal), Al_3Zr_2 (Al_3Zr_2 -type orthorhombic), AlZr (B_f , CrB -type orthorhombic), Al_4Zr_5 (Ga_4Ti_5 -type hexagonal), Al_3Zr_4 (Al_3Ir_4 -type hexagonal), Al_2Zr_3 (Al_2Zr_3 -type tetragonal), Al_3Zr_5 ($D8_m$, W_5Si_3 -type tetragonal), AlZr_2 ($B8_2$, Ni_2In -type hexagonal), and AlZr_3 ($L1_2$, AuCu_3 -type cubic). There are no intermediate phases in the La-Zr system and the mutual solubility between La and Zr is negligible.

Fig. 1 Al-La-Zr isothermal section at 500 °C [2010Pen]. Narrow two-phase regions are omitted

Ternary Isothermal Section

With starting metals of 99.9% Al, 99.99% La and 99.99% Zr, [2010Pen] arc-melted 61 alloys under Ar atm. After homogenization, the alloys were given a final anneal at 500 °C for > 240 h and quenched in liquid nitrogen. The phase equilibria were studied with x-ray powder diffraction and energy dispersive x-ray analysis attached to the scanning electron microscope. The isothermal section at 500 °C constructed by [2010Pen] is shown in Fig. 1. The binary compounds Al_7La_3 , Al_4Zr_5 and Al_3Zr_5 are not stable at this temperature. No ternary phase is present. The solubility of the third component in the binary compounds is negligible [2010Pen].

References

- 2010Pen:** D. Peng, Y. Zhan, J. She, M. Pang, and Y. Du, Phase Equilibria in the Ternary Al-Zr-La System, *J. Alloys Compd.*, 2010, **507**, p 62-66