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Al-Er-Ti (Aluminum-Erbium-Titanium)

V. Raghavan

Recently, [2000Lia] determined an isothermal section for this system at 500 °C.

Binary Systems

The Al-Er phase diagram [2002Cac] depicts five intermetallic compounds: $ErAl_3$ ($AuCu_3$-type cubic), $ErAl_2$ ($MgCu_2$-type cubic), ErAl (orthorhombic), Er_3Al_2 (Zr_3Al_2-type tetragonal), and Er_2Al (Co_2Si-type orthorhombic). An additional phase Er_2Al_{17} (Th_2Zn_{17}-type rhombohedral) was reported by [1993And] and confirmed by [2000Lia]. An updated Al-Ti phase diagram appears in this issue. The Er-Ti phase diagram [Massalski2] contains no intermediate phases. The mutual solid solubility between Er and Ti is limited.

Ternary Compounds

Two Al-rich ternary compounds were reported in this system by [1995Nie1,2]. $Er_6Ti_4Al_{43}$ (denoted τ_1 here) is $Ho_6Mo_4Al_{43}$-type hexagonal, space group $P6_3/mcm$, a = 1.1024 nm, and c = 1.7800 nm [1995Nie1]. The second compound $ErTi_2Al_{20}$ (τ_2) is $CeCr_2Al_{20}$-type cubic, space group $Fd3$ or $Fd3m$, a = 1.4662 nm [1995Nie2].

Isothermal Section

With starting metals of 99.9% purity, [2000Lia] melted 130 alloy compositions in an arc furnace under Ar atm. After a final anneal at 500 °C for 4 days, the samples were quenched in an ice-water mixture. The phase equilibria were studied mainly by x-ray powder diffraction. The isothermal section at 500 °C constructed by [2000Lia] is redrawn in Fig. 1 to agree with the accepted binary data. The two ternary compounds $Er_6Ti_4Al_{43}$ (τ_1) and $ErTi_2Al_{20}$ (τ_2) are stable at 500 °C. Er_2Al, Er_3Al_2 and $ErAl_2$ dissolve 2, 3, and 16 at.% Ti, respectively. The solubility of Er in the Ti-Al phases is 0.6 at.% or less.

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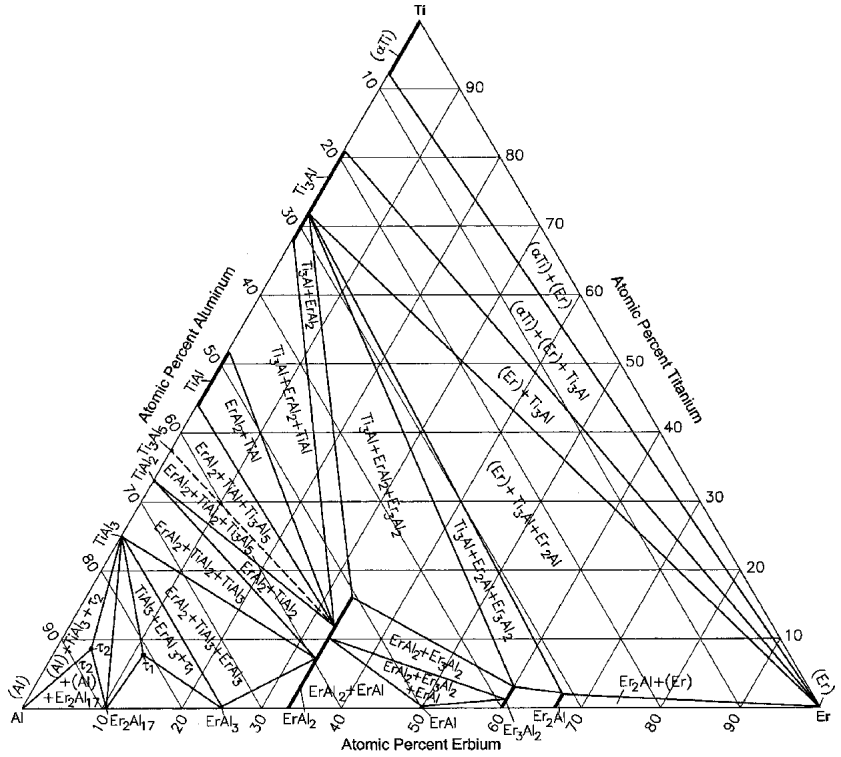

Fig. 1 Al-Er-Ti isothermal section at 500 °C [2000Lia]; narrow two-phase regions around tie-triangles are omitted.