JPEDAV (2005) 26:182-183
DOI: 10.1361/15477030523102
1547-7037/$19.00 ©ASM International

Al-Gd-Ti (Aluminum-Gadolinium-Titanium)

V. Raghavan

Recently, [2002Zho] determined an isothermal section for this system at 500 °C, which depicts two ternary compounds.

Binary Systems

The Al-Gd system [2000Sac] has five intermediate compounds of fixed stoichiometry: $GdAl_3$ ($D0_{19}$-type hexagonal), $GdAl_2$ ($C15$-type cubic), GdAl (ErAl-type orthorhombic), Gd_3Al_2 (Zr_3Al_2-type tetragonal), and Gd_2Al (Co_2Si-type orthorhombic). An update of the Al-Ti phase diagram appears in this issue. There are no intermediate phases in the Gd-Ti system [Massalski2].

Ternary Compounds

Two ternary compounds were reported in this system by [1995Nie1,2]. $Gd_6Ti_4Al_{43}$ (denoted τ_1 here) is $Ho_6Mo_4Al_{43}$-type hexagonal, space group $P6_3/mcm$, a = 1.1072 nm, and c = 1.7942 nm [1995Nie1]. The second compound $GdTi_2Al_{20}$ (τ_2) is $CeCr_2Al_{20}$-type cubic, space group $Fd3$ or $Fd3m$, a = 1.4684 nm [1995Nie2].

Ternary Isothermal Section

With starting materials of 99.9% purity, [2002Zho] melted 206 alloy samples in an arc furnace under Ar atm. The alloys were given a final anneal at 500 °C for 7 days and quenched in an ice-water mixture. The phase equilibria were studied by optical and scanning electron metallography, x-ray powder diffraction and electron probe microanalysis. The isothermal section constructed by [2002Zho] is redrawn in Fig. 1 to agree with the accepted binary data. The two ternary compounds found by [1995Nie1,2] are present at 500 °C [2002Zho]. The maximum solubilities of Ti in the binary compounds Gd_2Al, Gd_3Al_2, and $GdAl_2$ are 2.0, 3.5, and 16.3 at.%, respectively, with Ti substituting for Al. The solubility of the third component in the other binary phases is not significant.

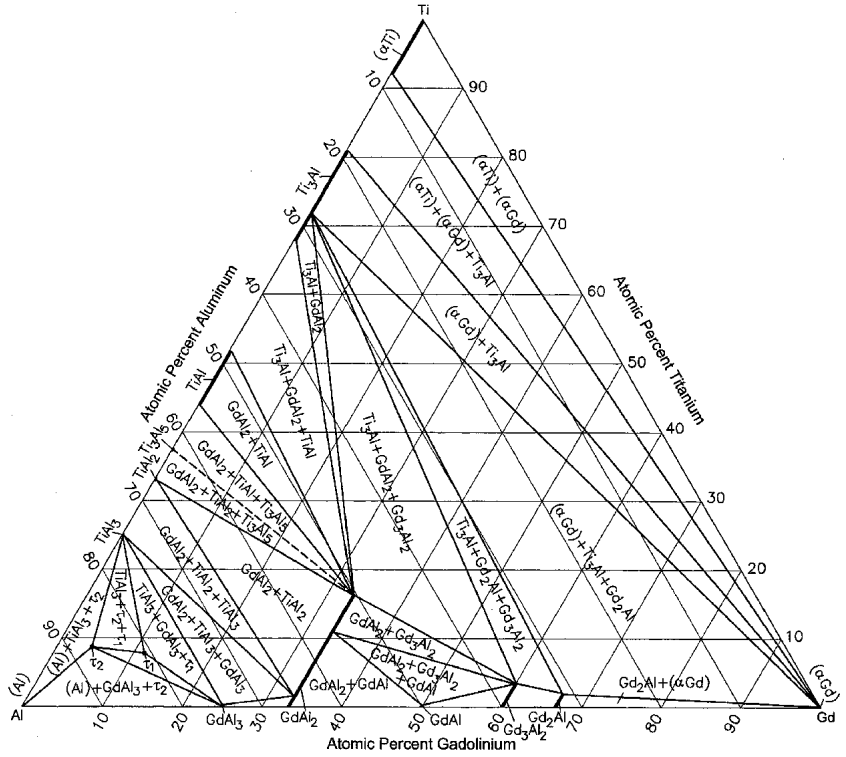

Fig. 1 Al-Gd-Ti isothermal section at 500 °C [2002Zho]; narrow two-phase regions around tie-triangles are omitted.

References

1995Nie1: S. Niemann and W. Jeitschko, Ternary Aluminides $A_6T_4Al_{43}$ (A = Y, Nd, Sm, Gd-Lu, and U; T = Ti, V, Nb, and Ta) with $Ho_6Mo_4Al_{43}$ Type Structure, *J. Solid State Chem.,* Vol 116, 1995, p 131-135

1995Nie2: S. Niemann and W. Jeitschko, Ternary Aluminides AT_2Al_{20} (A = Rare-Earth Elements and Uranium; T = Ti, Nb, Ta, Mo and W) with $CeCr_2Al_{20}$ Type Structure, *J. Solid State Chem.,* Vol 114, 1995, p 337-341

2000Sac: A. Saccone, A.M. Cardinale, S. Delfino, and R. Ferro, Gd-Al and Dy-Al Systems: Phase Equilibria in the 0 to 66.7 at.% Al Composition Range, *Z. Metallkde.,* Vol 91 (No. 1), 2000, p 17-23

2002Zho: H. Zhou, Y. Zhan, J. Yan, and S. Yuan, Phase Relationships in the Gd-Ti-Al Ternary System at 500 °C, *J. Mater. Sci.,* Vol 37, 2002, p 1203-1205