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Ag-Al-Nd (Silver-Aluminum-Neodymium)

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Kuzma et al. [1997Kuz] determined an isothermal section for this system at 497 °C (770 K), which depicts seven ternary compounds.

Binary Systems

The Ag-Al phase diagram [Massalski2] depicts three intermediate phases: Ag_3Al (20.5-29.8 at.% Al; denoted β, body-centered cubic; stable between 778 and ~600 °C), Ag_2Al (22.9-41.9 at.% Al; denoted δ, close-packed hexagonal), and μ (21-24 at.% Al, stable below 450 °C; *A*13, βMn-type cubic). The Ag-Nd phase diagram [Massalski2] has the following intermediate phases: $Ag_{51}Nd_{14}$ ($Ag_{51}Gd_{14}$-type hexagonal), βAg_2Nd (AlB_2-type hexagonal), αAg_2Nd ($CeCu_2$-type orthorhombic), and AgNd (*B*2, CsCl-type cubic). The Al-Nd phase diagram reassessed with new additional experimental input by [2005Gao] shows the following intermediate compounds: Nd_3Al ($D0_{19}$, Ni_3Sn-type hexagonal), Nd_2Al (*C*23, Co_2Si-type orthorhombic), NdAl (ErAl-type orthorhombic), $NdAl_2$ (*C*15, $MgCu_2$-type cubic), $\alpha NdAl_3$ (Ni_3Sn-type hexagonal), $\beta NdAl_3$ (stable between 1205 and 888 °C), $NdAl_4$ or βNd_3Al_{11} ($D1_3$, Al_4Ba-type tetragonal), and αNd_3Al_{11} (αLa_3Al_{11}-type orthorhombic).

Ternary Phases

The ternary compounds of this system that are present at 497 °C (770 K), denoted τ_1 to τ_7 (1 to 7 by [1997Kuz]), are listed in Table 1. The ternary solid solutions based on the binary compounds αAg_2Nd and AgNd dissolve 21.7 and 30 at.% Al, respectively. The compounds αNd_3Al_{11} and $NdAl_2$ dissolve 11.4 and 11.7 at.% Ag [1997Kuz].

Isothermal Section

With starting metals of 99.9% Ag, 99.99% Al, and 99.5% Nd, [1997Kuz] arc-melted 79 alloy compositions in Ar atm. The alloys were annealed at 497 °C for 700 h and quenched in water. Alloy compositions with > 50 at.% Ag or > 33 at.% Nd were annealed for 1200 h. The phase equilibria were studied by X-ray powder diffraction. The isothermal section at 497 °C (770 K) constructed by [1997Kuz] is redrawn in Fig. 1, to agree with the accepted binary data. The compositions of the ternary phases shown in Fig. 1 are from the listed values of [1997Kuz]. Ag_2Nd in Fig. 1 is the low-temperature modification with the $CeCu_2$-type structure.

Table 1 Ag-Al-Nd crystal structure and lattice parameter data [1997Kuz]

Phase	Composition, at.%	Pearson symbol	Space group	Prototype	Lattice parameter, nm
$Nd_{1.6}Ag_{6.5\text{-}7.5}Al_{10.5\text{-}9.5}$ (τ_1)	34.9-40.3 Ag 56.5-51.1 Al 8.6 Nd	*hP*38	$P6_3/mmc$	$Ni_{17}Th_2$	a = 0.9344 c = 0.9130
$Nd_2Ag_{9.5\text{-}10.4}Al_{7.5\text{-}6.6}$ (τ_2)	50-54.7 Ag 39.5-34.7 Al 10.5 Nd	*hR*19	$R\bar{3}m$	$Zn_{17}Th_2$	a = 0.9379 c = 1.3605
$NdAg_{2.54}Al_{2.46}$ (τ_3)	42.3 Ag 41Al 16.7 Nd	*hP*6	*P*6/*mmm*	$CaCu_5$	a = 0.5524 c = 0.4407
$NdAg_{2.75\text{-}3.25}Al_{2.4\text{-}1.9}$ (τ_4)	44.7-52.8 Ag 39.0-30.9 Al 16.3 Nd	...	$P6_3/mmc$	$DyAg_{2.4}Al_{2.6}$	a = 0.9303 c = 0.9521
$NdAg_{3.2}Al_{1.1}$ (τ_5)	60.4 Ag 20.75 Al 18.9 Nd	...	...	...	...
$NdAg_{1.0\text{-}1.2}Al_{3.0\text{-}2.8}$ (τ_6)	20-24 Ag 60-56 Al 20 Nd	*tI*10	*I*4/*mmm*	Al_4Ba	a = 0.42744 c = 1.1126
$NdAg_{0.80}Al_{2.20}$ (τ_7)	20 Ag 55 Al 25 Nd	*hR*12	$R\bar{3}m$	$PuNi_3$	a = 0.5614 c = 2.6700

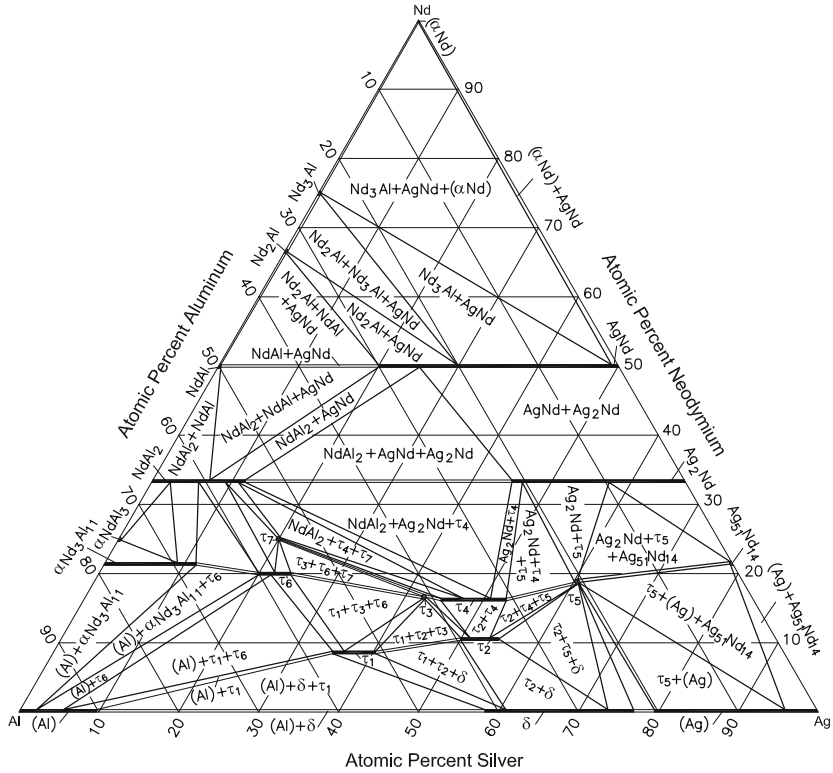

Fig. 1 Ag-Al-Nd isothermal section at 497 °C [1997Kuz]

References

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