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# Al-Nd-Si (Aluminum-Neodymium-Silicon)

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Recently, [2001Lon1] and [2001Lon2] reported an isothermal section at 500 °C for this ternary system in the Nd-lean region.

## Binary Systems

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), $Nd_2Al$ ($C23$, $Co_2Si$-type orthorhombic), NdAl (ErAl-type orthorhombic), $NdAl_2$ ($C15$, $MgCu_2$-type cubic), $\alpha NdAl_3$ ($Ni_3Sn$-type hexagonal), $\beta NdAl_3$ (stable between 1205 and 888 °C), $NdAl_4$ or $\beta Nd_3Al_{11}$ ($D1_3$, $Al_4Ba$-type tetragonal), and $\alpha Nd_3Al_{11}$ ($\alpha La_3Al_{11}$-type orthorhombic). The Al-Si phase diagram is a simple eutectic system with the eutectic reaction at 577 °C and 12.2 at.% Si. The Nd-Si phase diagram [Massalski2] depicts the following intermediate phases: $Nd_5Si_3$ ($D8_l$, $Cr_5Si_3$-type tetragonal), $Nd_5Si_4$ ($Si_4Zr_5$-type tetragonal), NdSi ($B27$, FeB-type orthorhombic), $Nd_2Si_3$ ($C32$, $AlB_2$-type hexagonal), $\alpha NdSi_2$ ($\alpha GdSi_2$-type orthorhombic), and $\beta NdSi_2$ ($C_c$, $ThSi_2$-type tetragonal).

## Ternary Isothermal Section

With starting metals of 99.99% Al, 99.9% Nd, and 99.999% Si, [2001Lon2] arc-melted or induction-melted 260 alloys under Ar atm. After homogenization, the alloys were given a final anneal at 500 °C for 7 days and quenched in water. The phase equilibria were studied by metallography, electron probe microanalysis, and x-ray powder diffraction. The isothermal section constructed by [2001Lon2] at 500 °C is shown in Fig. 1. The ternary compound labeled δ by [2001Lon2] at $NdAl_{1.75}Si_{0.25}$ is an extension of the binary compound $NdAl_2$ with the $MgCu_2$-type cubic structure [1967Ram]. The compound $NdAl_{1.25}Si_{0.75}$ (or $Nd_4Al_5Si_3$, denoted $\tau_1$ here) has a homogeneity range of $NdAl_{1+x}Si_{1-x}$ ($0 \le x \le 0.4$) [2001Lon1]. The compound of fixed stoichiometry $NdAl_2Si_2$ (denoted $\tau_2$ here) has the $La_2O_2S$-type of structure with space group $P\bar{3}m1$ and lattice parameters $a = 0.423$ nm and $c = 0.671$ nm [1984Gsc].

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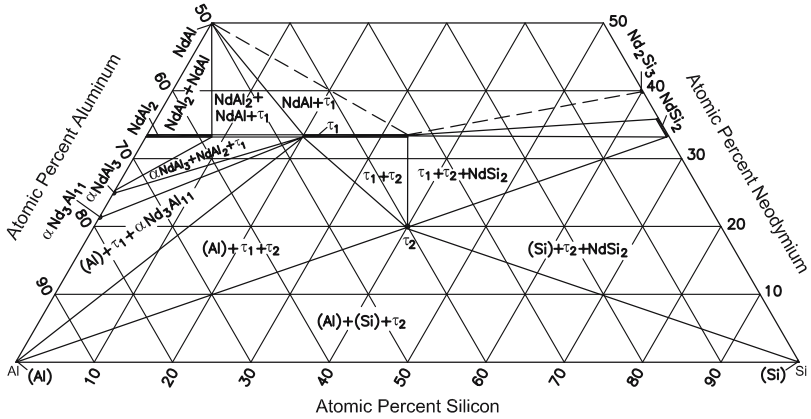


**Fig. 1** Al-Nd-Si isothermal section at 500 °C [2001Lon2]. Narrow two-phase regions are omitted