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Al-C-N (Aluminum-Carbon-Nitrogen)

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[1996Pie] determined an isothermal section at 1800 °C for this system and a vertical section along the Al_4C_3-AlN join.

Binary Systems

The Al-rich part of Al-C phase diagram [1991Har] shows that the only intermediate phase of the system Al_4C_3 ($D7_1$-type rhombohedral) forms through a peritectic reaction at 2173 °C between graphite and liquid containing 18.6 at.% C. The Al-N system [Massalski2] has one stoichiometric compound AlN (*B*4, ZnS-type hexagonal). The solubility of N in molten Al is extremely small.

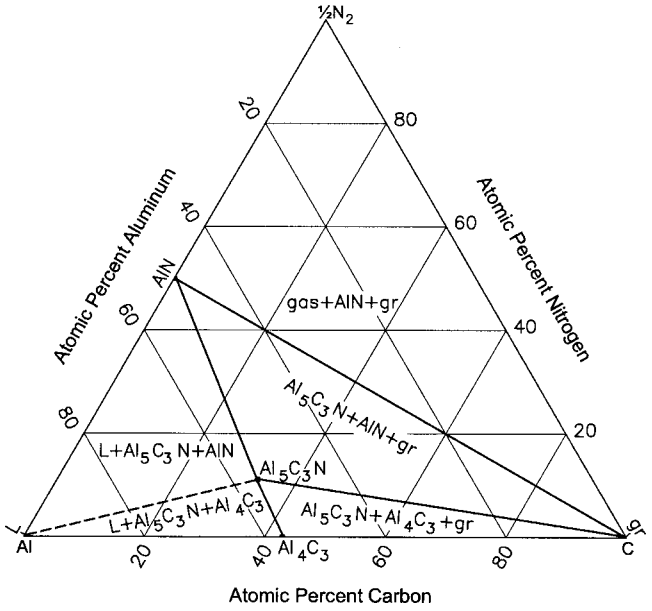

Fig. 1 Al-C-N isothermal section at 1800 °C [1996Pie]. Two-phase regions are not shown

Ternary Phase Equilibria

[1996Pie] determined a partial isothermal section for the Al-C-N system at 1800 °C, which is shown in Fig. 1. A ternary phase Al_5C_3N (Pearson symbol *hP*18, space group $P6_3mc$, hexagonal lattice parameters $a = 0.3281$ nm and $c = 2.167$ nm) forms tie-lines with graphite (gr), Al_4C_3, AlN, and liquid Al. None of the solid phases have a measurable homogeneity range. The other reported aluminum carbonitrides (see [Pearson3] for a listing) were found to be impurity-stabilized. The phase equilibria in Fig. 1 remain unchanged at 1500 °C [1996Pie].

A schematic vertical section along the Al_4C_3-AlN join is shown in Fig. 2 [1996Pie]. The ternary compound Al_5C_3N forms through a peritectic reaction at 2185 °C: gr + AlN + $L_{Al} \rightarrow Al_5C_3N$.

References

1991Har: K.C. Hari Kumar and V. Raghavan, A Thermodynamic Analysis of the Al-C-Fe System, *J. Phase Equilibria,* 1991, **12**(3), p 275-286

1996Pie: M.A. Pietzka and J.C. Schuster, Phase Equilibria in the Quaternary System Ti-Al-C-N, *J. Am. Ceram. Soc.,* 1996, **79**(9), p 2321-2330

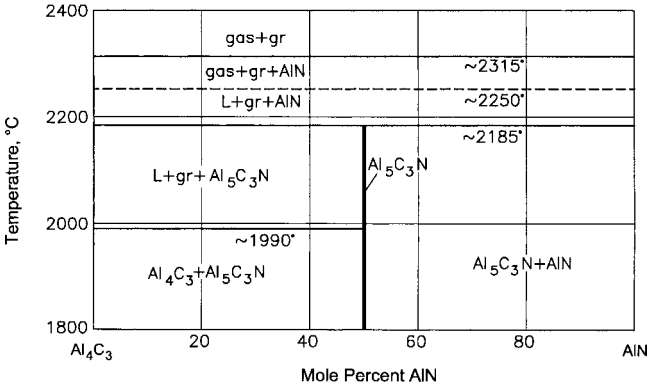

Fig. 2 Al-C-N schematic vertical section along the Al_4C_3-AlN join [1996Pie]