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Al-C-Y (Aluminum-Carbon-Yttrium)

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The previous experimental work on this system [1965Ros, 1988Nas] presented isothermal sections at 950 and 570 °C. [1995Gro] reported a thermodynamic assessment of this system and presented isothermal sections at 1727 and 527 °C and a vertical section at constant Al/C atom ratio.

Binary Systems

In the Al-C system [1991Har], the stoichiometric compound Al_4C_3 ($D7_1$-type rhombohedral) is known. The Al-Y phase diagram [Massalski2, 1995Gro] depicts the following intermediate phases: αAl_3Y ($D0_{19}$, Ni_3Sn-type hexagonal), βAl_3Y ($BaPb_3$-type rhombohedral), Al_2Y ($C15$, $MgCu_2$-type cubic), AlY (B_f, CrB-type orthorhombic), Al_2Y_3 (Al_2Zr_3-type tetragonal), and AlY_2 ($C23$, Co_2Si-type orthorhombic). The C-Y phase diagram [Massalski2, 1995Gro] depicts the following intermediate phases: γ (~22-72 at.% C; $L'1$, Fe_4N-type cubic), $\beta Y_{15}C_{19}$, $\alpha Y_{15}C_{19}$ ($Sc_{15}C_{19}$-type tetragonal), βY_2C_3, αY_2C_3, βYC_2, and αYC_2 ($C11_a$, CaC_2-type tetragonal).

Ternary Phases

Two ternary compounds have been established in this system: Y_3AlC (CaO_3Ti-type cubic, denoted τ_1 here) and YAl_3C_3 ($ScAl_3C_3$-type hexagonal, denoted τ_2 here). A third ternary phase described at the composition $Al_{22}C_{58}Y_{20}$ by [1988Nas] has not been confirmed.

Ternary Phase Equilibria

With starting metals of 99.95% Al, 99.9% Y and pure C, [1995Gro] synthesized the two ternary compounds Y_3AlC and YAl_3C_3 and measured their melting temperatures to be ~1650 and ~1550 °C respectively. Using these results and the experimental data from the literature on phase equilibria and thermodynamic properties, [1995Gro] optimized and listed the interaction parameters. Two isothermal sections at 1727 and 527 °C and a vertical section at constant Al/Y atom ratio were computed. The isothermal section at 527 °C in Fig. 1 depicts the subsolidus phase relations.

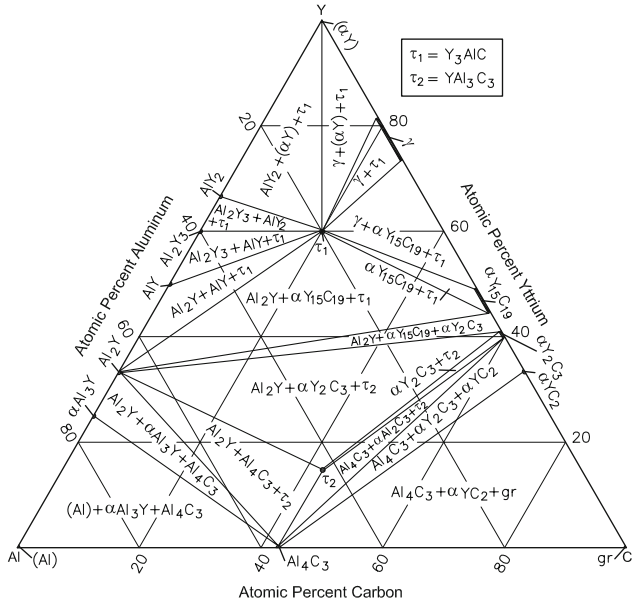

Fig. 1 Al-C-Y computed isothermal section at 527 °C [1995Gro]. Narrow two phase regions are omitted

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