

Al-Cr-Ni (Aluminum-Chromium-Nickel)

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A review of the recent literature on this ternary system was presented by [2006Rag]. Very recently, [2006Kit] redetermined the isothermal section at 1150 °C for this system and found that the solubility of Cr in Ni₃Al (γ') and NiAl (β) phases was significantly higher than that found earlier.

Binary Systems

The Al-Cr phase diagram depicts a number of intermediate phases with significant ranges of homogeneity: CrAl₇ (V₇Al₄₅-type monoclinic), Cr₂Al₁₁ (CrAl₅-type monoclinic), CrAl₄ (hexagonal), Cr₂Al (MoSi₂-type tetragonal), and an unconfirmed low-temperature phase X at ~75 at.% Cr. Between 30 and 41 at.% Cr, five phases have been reported: α Cr₄Al₉, β Cr₄Al₉, γ Cr₄Al₉, α Cr₅Al₈, and β Cr₅Al₈, with no well-established phase boundaries between them [2000Mah]. The Al-Ni phase diagram [1993Oka] shows five intermediate phases: NiAl₃ (D0₁₁, Fe₃C-type orthorhombic), Ni₂Al₃ (D5₁₃-type hexagonal), NiAl (B2, CsCl-type cubic, denoted β), Ni₅Al₃ (Ga₃Pt₅-type orthorhombic), and Ni₃Al (L1₂, AuCu₃-type cubic, denoted γ'). The Cr-Ni phase diagram is of the simple eutectic type, with Ni dissolving up to ~50 at.% Cr and Cr dissolving up to ~32 at.% Ni.

Ternary Isothermal Section

Using starting metals of purity of ~99.99 mass%, [2006Kit] arc-melted 15 Ni-rich ternary alloys. They were annealed at 1150 °C for 550 h and quenched in water. Diffusion couples were also prepared and annealed at 1150 °C for 100 h. The phase equilibria were studied with optical and scanning electron microscopy, electron probe microanalysis, and x-ray diffraction. On the basis of their results, [2006Kit] constructed an isothermal section at 1150 °C, which is redrawn in Fig. 1. The solubility of Cr in NiAl (β) and Ni₃Al (γ') was found to be 17 and 9 at.% respectively. These values are significantly larger than those

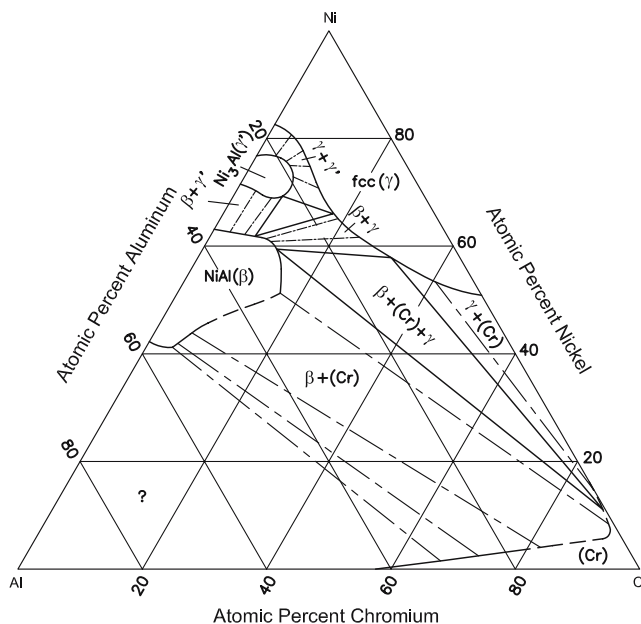


Fig. 1 Al-Cr-Ni isothermal section at 1150 °C [2006Kit]

reported in the previous studies. The Al-rich corner was not investigated by [2006Kit].

References

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