

Al-Co-Gd (Aluminum-Cobalt-Gadolinium)

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Recently, [2007Zho] determined an isothermal section for this system at 900 °C for Gd content up to 33.3 at.%.

Binary Systems

The Al-Co phase diagram [1996God] shows the following intermediate phases: CoAl (48-78.5 at.% Co; B2, CsCl-type cubic), Co₂Al₅ (D8₁₁-type hexagonal), CoAl₃ (D0₁₁, Fe₃C-type orthorhombic), Co₄Al₁₃ (three modifications with one orthorhombic and two monoclinic forms), and Co₂Al₉ (D8₇-type monoclinic). The Al-Gd system [Massalski2] has the following intermediate phases GdAl₃ (D0₁₉, Ni₃Sn-type hexagonal), GdAl₂ (C15, MgCu₂-type cubic), GdAl (ErAl-type orthorhombic), Gd₃Al₂ (Zr₃Al₂-type tetragonal), and Gd₂Al (C23, Co₂Si-type orthorhombic). The Co-Gd system [Massalski2, 2007Zho] depicts the following intermediate phases: Co₁₇Gd₂ (Th₂Zn₁₇-type rhombohedral), Co₅Gd (D2_d, CaCu₅-type hexagonal), Co₇Gd₂ (Ce₂Ni₇-type hexagonal), Co₃Gd (Be₃Nb-type rhombohedral), Co₂Gd (C15, MgCu₂-type cubic), Co₃Gd₄ (hexagonal), Co₇Gd₁₂ (monoclinic), and CoGd₃ (D0₁₁, Fe₃C-type orthorhombic).

Ternary Isothermal Section

With starting metals of >99.9% purity, [2007Zho] arc-melted under Ar atm 104 alloys with Gd up to 33.3 at.%. The alloys were annealed at 900 °C for 2 weeks and quenched in water. The phase equilibria were studied using x-ray diffraction and scanning electron microscopy with energy dispersive x-ray analysis. The isothermal section at 900 °C constructed by [2007Zho] is shown in Fig. 1. The ternary phase τ (C14, MgZn₂-type hexagonal; denoted δ by [2007Zho]) has an Al range of 30-45 at.% at constant Gd content of 33.3 at.%. The maximum solubilities of Al in Co₁₇Gd₂, Co₅Gd, and Co₂Gd are 17, 25 and 15 at.% respectively. The solubility of Co in GdAl₂ is 16 at.%. CoAl and (Co) dissolve less than 2 at.% Gd.

References

- 1996God:** T. Godecke and M. Ellner, Phase Equilibria in the Aluminum-Rich Portion of the Binary System Co-Al and In the Co/Al-Rich Portion of the Ternary System Co-Ni-Al, *Z. Metallkd.*, 1996, **87**(11), p 854-864
- 2007Zho:** B. Zhou, Z. Gu, J. Li, G. Cheng, J. Cheng, C. Xu, and L. Ma, Solid State Phase Equilibria in the Gd-Co-Al Ternary System at 1173 K, *J. Alloys Compd.*, 2007, **430**, p 132-135

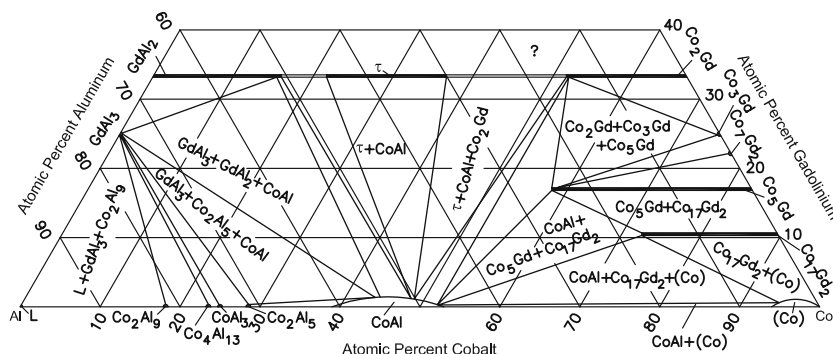


Fig. 1 Al-Co-Gd isothermal section at 900 °C [2007Zho]