

Al-Co-Ni-Ti (Aluminum-Cobalt-Nickel-Titanium)

V. Raghavan

The data on this quaternary system are limited to the $B2$ - $L2_1$ phase boundary on the NiAl-NiTi-CoTi-CoAl plane of the composition tetrahedron [2002Ish].

Binary and Ternary Systems

An update of the Al-Ti phase diagram appears in this issue. For brief descriptions of the Al-Co and Co-Ti phase diagrams, see the Al-Co-Ti update in this issue. For Al-Ni, Co-Ni, and Ni-Ti phase diagrams, see [Massalski2]. The binary phases CoAl, CoTi, NiAl, and NiTi all have the CsCl-type $B2$ structure.

Compilations of data on the Al-Co-Ni, Co-Ni-Ti and Al-Ni-Ti ternary systems are given in [1995Vil]. An update of the Al-Co-Ti system appears in this issue. For the limited purpose of this update, we note that complete solid solubility exists between CoAl and NiAl and that the Heusler-type $L2_1$ phases Co_2AlTi and Ni_2AlTi are present along the CoAl-CoTi and NiAl-NiTi joins, respectively.

Quaternary Phase Equilibria

With starting metals of 99.9% purity, [2002Ish] melted alloys in an arc furnace under Ar atmosphere. The diffusion couples prepared by welding were annealed at the desired temperatures. Compositions of the coexisting phases were measured by energy dispersion x-ray spectroscopy. The phase relationships in the NiAl-Ni₂AlTi-Co₂AlTi-CoAl plane determined by [2002Ish] at 1300, 1200, and 1100 °C are redrawn in Fig. 1. Up to about 30-40 at.% Co, the $B2 \rightarrow L2_1$ transition is first-order in nature with a two-phase field present. The two-phase field broadens with decreasing temperature.

References

- 1995Vil:** P. Villars, A. Prince, and H. Okamoto, *Handbook of Ternary Alloy Phase Diagrams*, ASM International, Vol 3, 1995, p 3050-3063 (Al-Co-Ni), Vol 4, p 4195-4216 (Al-Ni-Ti), and Vol 7, p 8594-8596 (Co-Ni-Ti)
- 2002Ish:** K. Ishikawa, H. Mitsui, I. Ohnuma, R. Kainuma, K. Aoki, and K. Ishida, Ordering and Phase Separation of BCC Aluminides in (Ni,Co)-Al-Ti System, *Mater. Sci. Eng. A*, Vol A329-331, 2002, p. 276-281

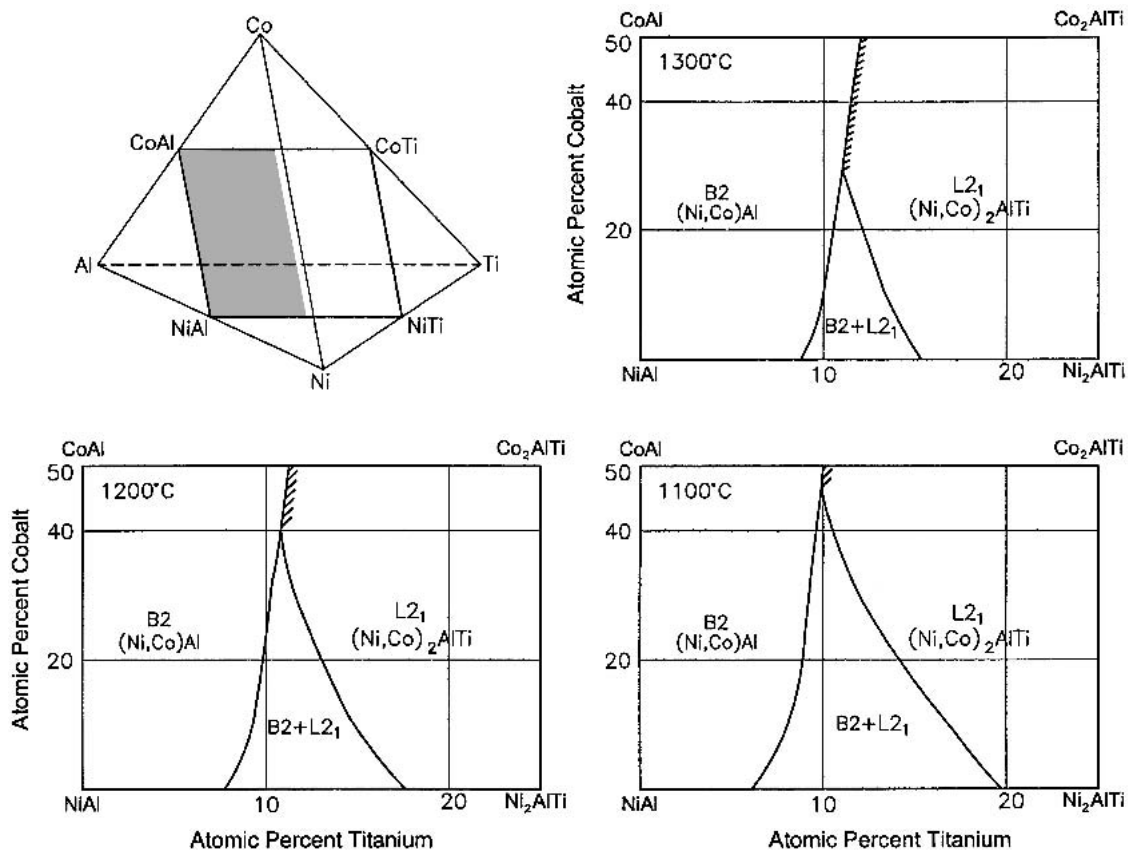


Fig. 1 Al-Co-Ni-Ti isothermal $B2$ - $L2_1$ - $B2$ phase equilibria on the NiAl-NiTi-CoTi-CoAl plane of the composition tetrahedron [2002Ish]