

## Al – Co (Aluminum – Cobalt)

### Phase diagram

Gödecke et al. [96 Göd] have investigated thoroughly the phase equilibria at concentrations between 22 and 28.5 at% Co. The results are given in Fig. 1. The phase equilibria in the range between Al and 50 at% Al determined, using several experimental methods, and also published by [96 Göd] (differential thermal analysis, metallographic observations, X-ray diffraction analysis) have been reproduced in Fig. 2.

In the similar region, also, Gruschko et al. [96 Gru] have reinvestigated the phase diagram.

Ellner et al. [92 Ell] have investigated phase equilibria in alloys between 68 and 75 at% Co. In this region the authors found neither a stable nor a metastable phase of the stoichiometry  $\text{AlCo}_3$ . They pointed out, however, that at high pressure a metastable phase  $\text{AlCo}_3$  (p) of  $\text{Cu}_3\text{Au}$ -type should be possible.

Furtheron, it should be mentioned that Kimura et al. [93 Kim] have confirmed the solidus curves at concentrations  $> 50$  at% Co using DTA.

### Metastable alloys

By mechanical alloying, using ball milling of a mixture of Al powder with powder of monoclinic  $\text{Al}_{13}\text{Co}_4$ , Tsurui et al. [95 Tsu] have prepared the intermediate compound  $\text{Al}_{85}\text{Co}_{15}$ . This compound cannot be produced by milling of powder of the elements Al and Co.

Ma et al. [92 Ma] succeeded in preparing a two-dimensional decagonal quasicrystal in the composition range between  $\text{Al}_{11}\text{Co}_4$  to  $\text{Al}_{10}\text{Co}_4$  by slow solidification of the melt. Furtheron, these authors found an orthorhombic phase  $\text{Al}_3\text{Co}$ . The lattice constants are:

$$a = 1.25 \text{ nm}$$

$$b = 0.81 \text{ nm}$$

$$c = 1.46 \text{ nm}$$

### Crystal structure

Grin et al. [94 Gri] have thoroughly reinvestigated the structure of  $\text{Al}_{13}\text{Co}_4$ . To obtain high precision of the results the authors took a single crystal homogenized at 1123 K (3 drops) using an Enraf-Nonius FR 552 Guinier camera. The structure found is orthorhombic. The refined lattice constants are:

$$a = 0.8158 (1) \text{ nm}$$

$$b = 1.2342 (1) \text{ nm}$$

$$c = 1.4452 (2) \text{ nm}.$$

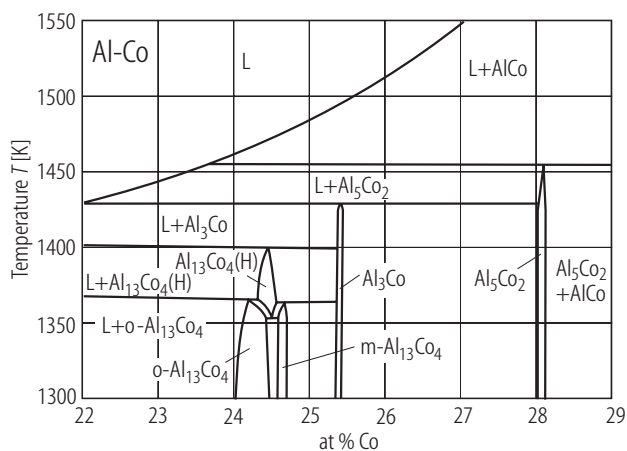
This structure found is constructed from segments like in  $\text{Al}_3\text{Fe}_4$ , but the sequence of stacking the segments is different.

### Thermodynamics

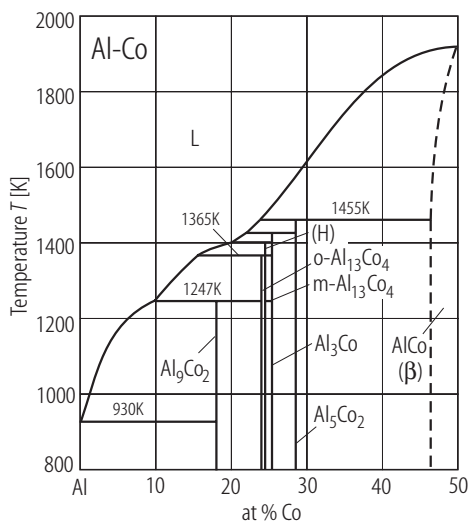
Meschel et al. [93 Mes] determined calorimetrically the standard enthalpy of formation of  $\text{AlCo}$ . It is:

$$\Delta H_{298}^S = -53.4 \pm 1.4 \text{ kJ g-atom}^{-1}$$

## Figures



**Fig. 1. Al-Co.** Phase equilibria between 22 and 28.5 at% Co [96 Göd].



**Fig. 2. Al-Co.** Phase equilibria between Al and 50 at% Co [96 Göd].

## References

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