

Al – Pd (Aluminum – Palladium)

Phase diagram

By splat cooling crystallization of Al_4Pd could be suppressed. Instead of this phase, metastable Al_3Pd (m) or two phase mixtures (Al) + Al_3Pd or Al_3Pd_2 could be found [82 Ell].

Lee et al. [91 Lee] have studied the phase formation in Al-Pd thin film by ion beam mixing and thermal annealing. The starting material was a film prepared by sequential evaporation. Then the material was mixed by Ar^+ ion bombardment. Intermediate phases Al_3Pd_2 and AlPd were formed by this procedure. By thermal annealing for 1 h at 623 K after the mentioned irradiation procedure in addition the phases Al_3Pd and Al_3Pd_5 were formed. Annealing with Ar^+ bombardment yields the phases Al_3Pd , Al_3Pd_2 and AlPd .

Crystal structure

Crystallographic data of intermediate phases are collected in Table 1 (see [Pearson] and [Massalski]).

Table 1. Al–Pd. Crystallographic data of intermediate phases.

Phase	Composition [at% Pd]	Structure	Prototype	Lattice parameters [nm]		
				<i>a</i>	<i>b</i>	<i>c</i>
λ	~20	hex	Al_4Pt			
γ	~27.6	ort				
δ	38 ... 41.5	hex	Al_3Ni_2	0.4219		0.5161
β	44 ... 56	cub	CsCl	0.30532		
β'	48.5 ... 52.8	hex				
μ	48 ... 49	cub	FeSi	0.459		
ν	62.5	ort	Ge_3Rh_5	0.535	1.041	0.403
ρ	65 ... 73	ort	Co_2Si	0.540	0.407	0.777
τ	70.5 ... 71.7	ort	Ga_2Pd_5			

By rapid solidification of a liquid Al-Pd alloy with 16.6 at% Pd a decagonal quasicrystal has been prepared. Annealing of this metastable phase at 873 K transforms it to an orthorhombic Al_3Pd phase (lattice parameters: $a = 2.34$ nm; $b = 1.67$ nm; $c = 1.23$ nm).

Thermodynamics

By high-temperature calorimetry, Jung et al. [91 Jun] have determined the enthalpy of formation of AlPd . It amounts to

$$\Delta H^S = -182 \pm 9 \text{ kJ g-atom}^{-1}$$

References

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