

Al – Ba (Aluminum – Barium)

Phase diagram

The phase diagram Al-Ba published by Srikanth et al. [91 Sri] and shortly discussed by Okamoto [92 Oka] is reproduced in Fig. 1.

[75 Bru] has found the intermediate phase Al_5Ba_3 , which is not included in Fig. 1.

Crystal structure

[92 Oka] stated, that Al_2Ba in reality is an intermediate phase with the stoichiometry $\text{Al}_{13}\text{Ba}_7$. Instead of AlBa there has to be written Al_5Ba_4 .

Crystallographic data are compiled in Table 1.

Table 1. Al–Ba. Crystallographic data of intermediate phases (taken from [92 Oka]).

Phase	Concentration [at% Ba]	Structure	Type	Lattice parameters [nm]		Reference
				<i>a</i>	<i>c</i>	
Al_4Ba	20	tet	Al_4Ba	0.4566	1.1250	[35 And], [57 Das]
$\text{Al}_{13}\text{Ba}_7$	35	hex		0.6099	1.7269	[75 For]
Al_5Ba_3	37.5	hex		0.6066	1.4611	[88 For]
Al_5Ba_4	44.4	hex		0.6092	1.7782	[75 For]

Figures

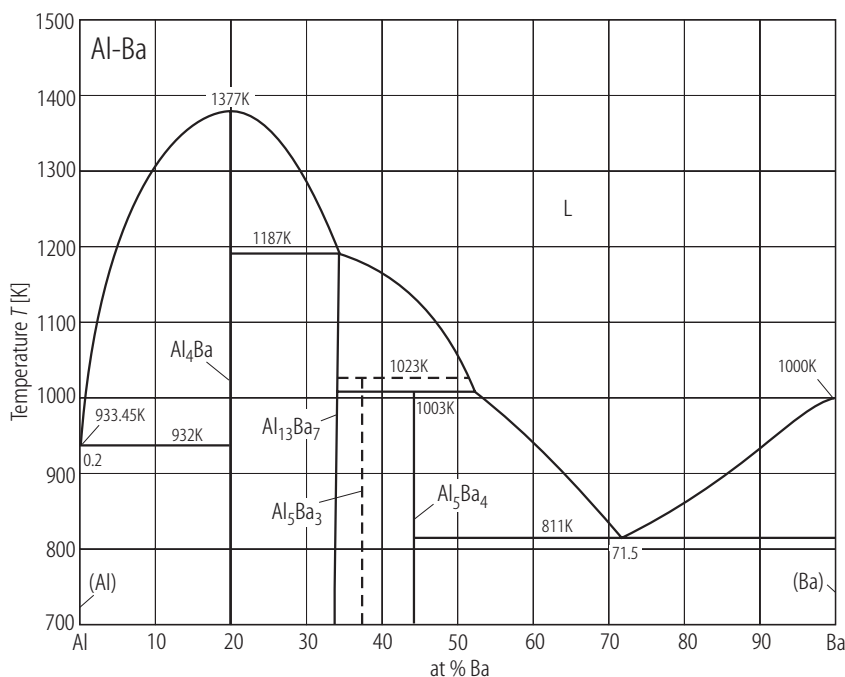


Fig. 1. Al–Ba. Phase diagram Al–Ba taken from [92 Oka].

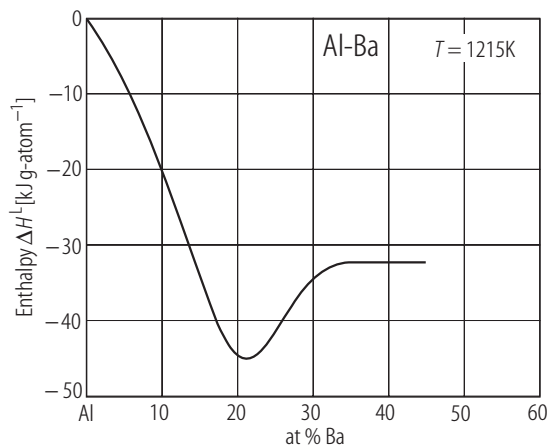


Fig. 2. Al–Ba. Enthalpies of mixing of liquid alloys taken from Notin et al. [82 Not].

Thermodynamics

The partial enthalpies of Ba for liquid alloys have been measured by drop calorimetry at $T = 1196$ K and concentrations < 47 at% Ba [82 Not]. From the results integral enthalpies of mixing have been calculated. The ΔH^L -values are plotted in Fig. 2.

For concentrations < 5.6 at% Ba the dependence of ΔH^L on barium content is almost linear. At Ba-contents > 33.3 at% Ba the enthalpies of mixing are almost constant.

Notin et al. [82 Not] have estimated the standard enthalpy of formation for Al_4Ba to be

$$\Delta H_{298}^S = -37.1 \pm 1.5 \text{ kJ g-atom}^{-1}$$

Thermodynamic activities of Ba in liquid alloys were determined by Vigdorovich et al. [72 Vig], Burylev et al. [74 Bur] and Srikanth et al. [91 Sri]. All these authors used the Knudsen effusion techniques. The results obtained are presented in Table 2 (from [93 Itk]).

Table 2. Al–Ba. Thermodynamic activities of Ba in liquid alloys. Standard states: liquid Al and Ba.

Reference	Temperature [K]	Composition [at% Ba]	a_{Ba}^{L}
[72 Vig]	1273	8	$1.56 \cdot 10^{-3}$
	1273	32	$2.85 \cdot 10^{-2}$
	1173	75	0.46
[74 Bur]	1373	75	0.60 (a)
	1373	10.0	$9.504 \cdot 10^{-4}$
	1223	20.0	$3.455 \cdot 10^{-3}$
[91 Sri]	1373	33.0	$3.548 \cdot 10^{-2}$
		70.0	0.740 (b)
		9.2	$5.42 \cdot 10^{-4}$
		18.7	$3.90 \cdot 10^{-3}$
		26.1	$1.40 \cdot 10^{-2}$
		38.0	$6.90 \cdot 10^{-2}$
		49.8	0.223
		60.9	0.459
		68.7	0.627
		79.2	0.837
		90.4	0.929

(a) extrapolated value

(b) estimated value

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