

## Al – La (Aluminum – Lanthanum)

### Phase diagram

Single crystals of AlLa intermediate phase have been prepared by Leineweber et al. [98 Lei].

By X-ray investigation it was found an orthorhombic unit cell with lattice parameters:

$$a = 0.9455 \text{ nm}$$

$$b = 0.7753 \text{ nm}$$

and  $c = 0.5791 \text{ nm}$ .

After assessment of thermodynamic data (see below) Yin et al. [00 Yin] have calculated the phase diagram of this system. The results are reproduced in Fig. 1.

### Thermodynamics

A thermodynamic assessment of the Al-La system has been performed by [00 Yin]. From there following thermodynamic data have been taken.

Starting from thermodynamic properties and phase equilibria determined experimentally, [00 Yin] have calculated optimized energetic data shown in Fig. 2 (enthalpies of mixing of liquid alloys), enthalpies of formation of solid alloys (Fig. 3), as well as thermodynamic activities of liquid alloys (Fig. 4).

By calorimetry Feufel et al. [97 Feu] have determined enthalpies of mixing of ternary Al-La-Ni-alloys. Using an association model, enthalpies of mixing of binary Al-La liquid and undercooled liquid alloys at 1200 K have been calculated. The results are similar to those plotted in Fig. 2.

The entropy of mixing for liquid and undercooled liquid alloys (at 1200 K) as  $T \cdot \Delta S^L$  published by [97 Feu] is plotted in Fig. 1.

Borzone et al. [97 Bor] have determined standard enthalpies of formation of intermediate phases. The results obtained are given in Table 1.

**Table 1. Al–La.** Standard enthalpies of formation of intermediate phases.

Phase	$\Delta H_{298}^S$ [kJ g-atom <sup>-1</sup> ]
AlLa	- 46.0 ± 2
Al <sub>2</sub> La	- 50.5 ± 2
Al <sub>3</sub> La	- 44.0 ± 2
Al <sub>11</sub> La <sub>3</sub>	- 41.0 ± 2

## Figures

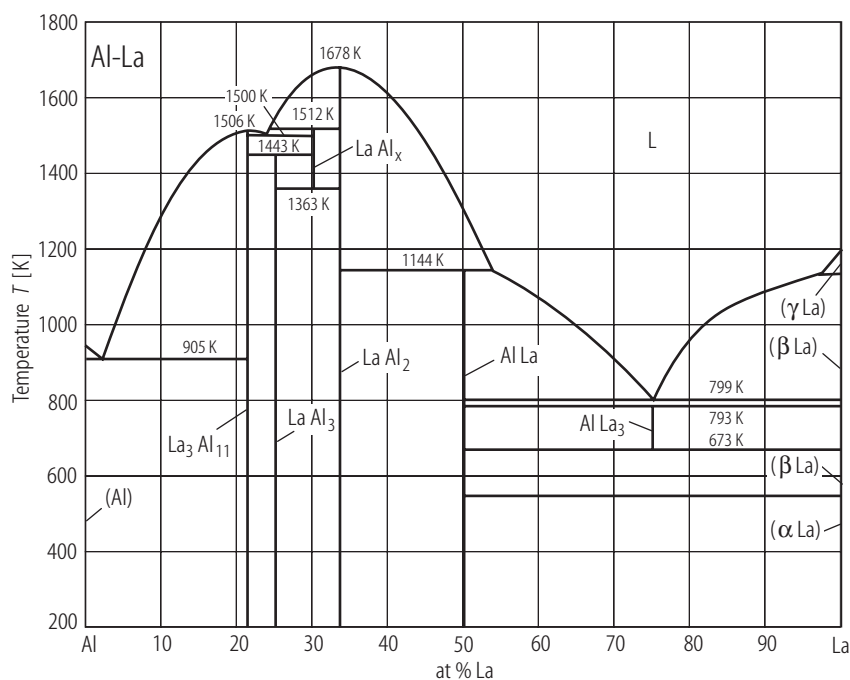


Fig. 1. Al-La. Phase diagram calculated by [00 Yin].

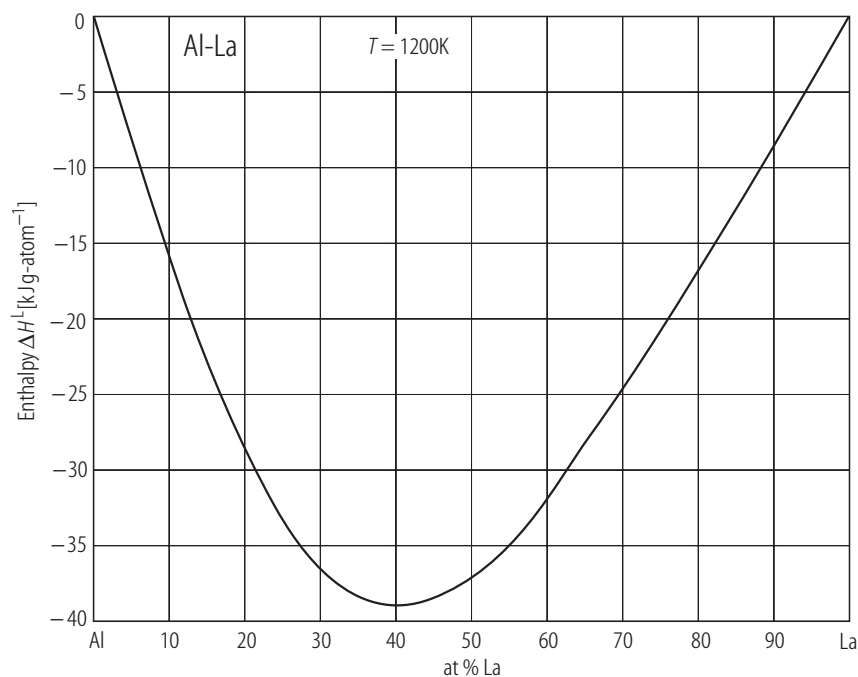
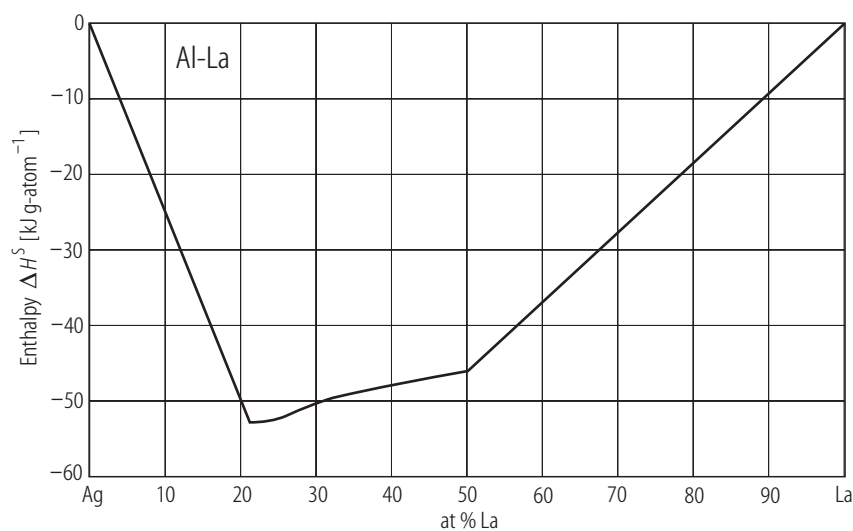
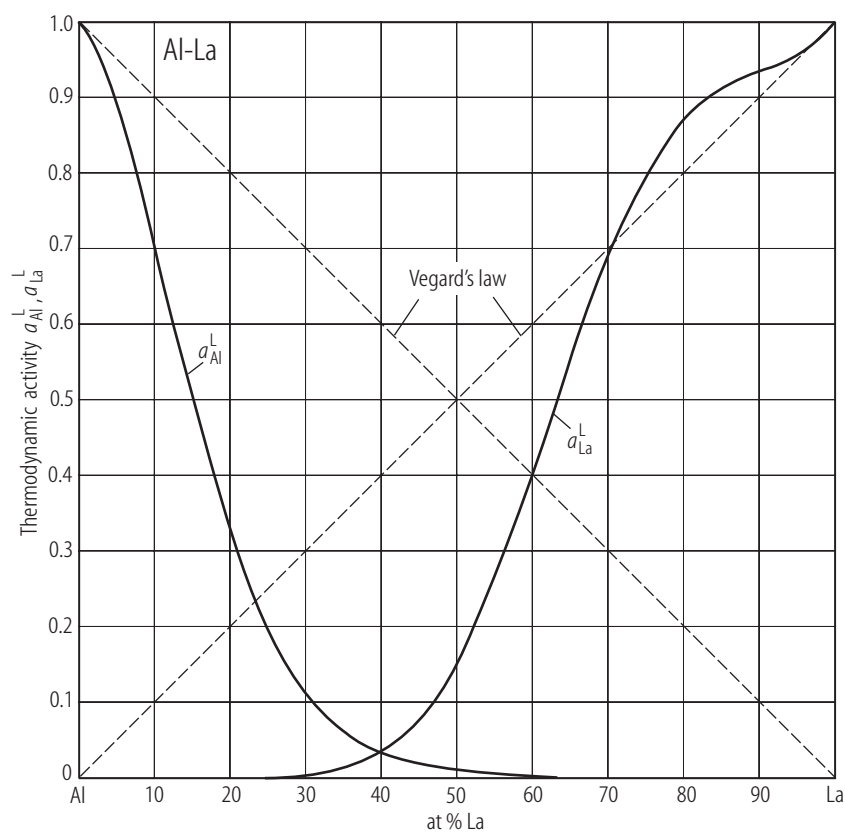


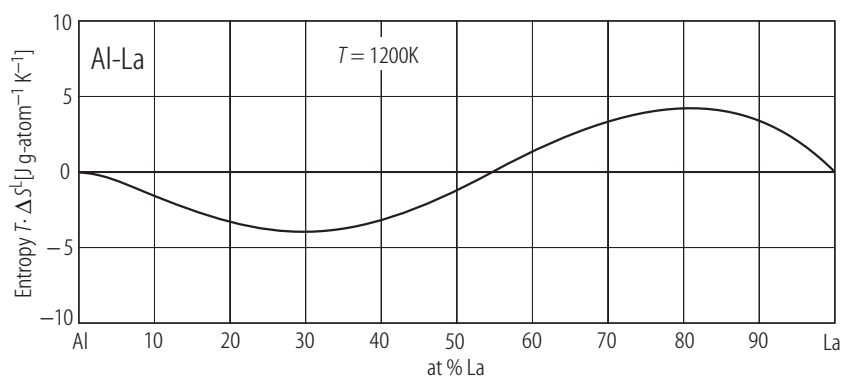
Fig. 2. Al-La. Enthalpies of mixing of liquid Al-La alloys calculated by [00 Yin] [97 Feu].



**Fig. 3. Al-La.** Enthalpies of formation of solid alloys [00 Yin].



**Fig. 4. Al-La.** Thermodynamic activities of liquid alloys [00 Yin].



**Fig. 5. Al–La.** Entropy of mixing for liquid and undercooled liquid Al-La alloys.

### References

- [97 Bor] Borzone, G., Cardinale, A.M., Parodi, N., Cacciamani, G.: J. Alloys and Comp. **247** (1997) 141
- [97 Feu] Feufel, H., Schuller, F., Sommer, F.: J. Alloys and Comp. **257** (1997) 234
- [98 Lei] Leineweber, A., Jacobs, H.: J. Alloys and Comp. **278** (1998) L10
- [00 Yin] Yin, F., Su, X., Li, Z., Huang, M., Shi, Y.: J. Alloys and Comp. **302** (2000) 169