

## Al – Re (Aluminum – Rhenium)

### Phase Diagram

Huang et al. [98 Hua] have published a thermodynamic analysis of this system, including all thermodynamic data which are available from literature. The resulting phase diagram is plotted in Fig. 1. The corresponding invariant reaction temperatures and compositions are collected in Table 1.

Cornish et al. [99 Cor], using metallographic methods and X-ray diffraction, have confirmed the existence of the intermediate phases  $\text{Al}_{12}\text{Re}$ ,  $\text{Al}_6\text{Re}$ ,  $\text{Al}_4\text{Re}$  and  $\text{Al}_{11}\text{Re}_4$ . Furtheron,  $\text{Al}_2\text{Re}_3$  and  $\text{Al}_2\text{Re}$  have been mentioned, which are not included in Table 1.

**Table 1. Al–Re.** Invariant reaction temperatures and composition.

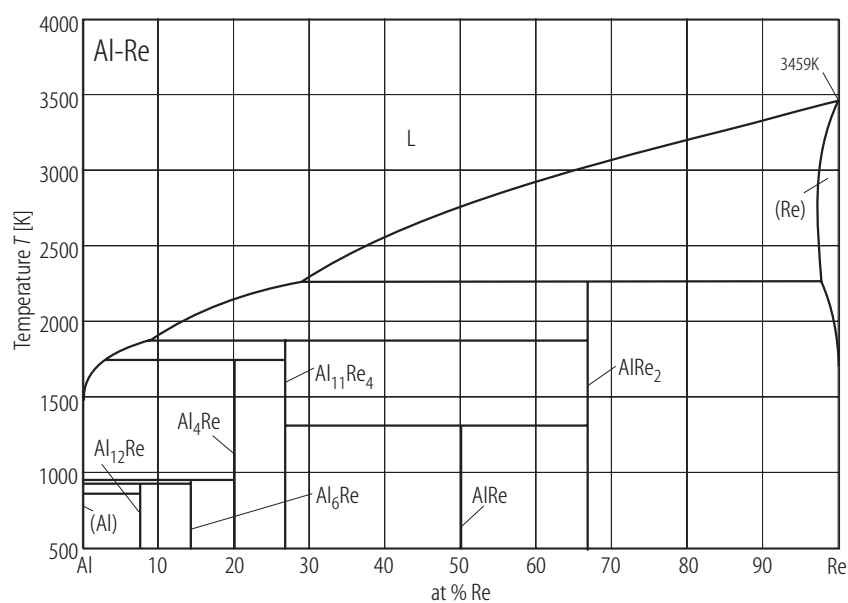
Reaction	Temperature [K] (experimental)	Temperature [K] (calculated)	Liquidus [at% Re] (calculated)
$\text{L} + \text{hcp} \rightarrow \text{AlRe}_2$	$2273 \pm 25$	2275	28.8
$\text{L} + \text{AlRe}_2 \rightarrow \text{Al}_{11}\text{Re}_4$	$1863 \pm 25$	1876	9
$\text{L} + \text{Al}_{11}\text{Re}_4 \rightarrow \text{Al}_4\text{Re}$	$1758 \pm 25$	1739	2.6
$\text{L} + \text{Al}_4\text{Re} \rightarrow \text{Al}_6\text{Re}$	$963 \pm 10$	964	0
$\text{fcc} + \text{Al}_6\text{Re} \rightarrow \text{Al}_{12}\text{Re}$	$873 \pm 25$	875	-
$\text{Al}_{11}\text{Re}_4 + \text{AlRe}_2 \rightarrow \text{AlRe}$	$1323 \pm 50$	1323	-

### Thermodynamics

The enthalpies of formation of two intermediate phases have been calculated by Meschel et al. [93 Mes] from results of direct reaction calorimetry. The values are given in Table 2 [93 Mes].

**Table 2. Al–Re.** Standard enthalpies of formation of intermediate phases in  $[\text{kJ g-atom}^{-1}]$ .

Phase	$\Delta H_{298}^{\circ}$
$\text{AlRe}_2$	$-29.6 \pm 0.9$
$\text{Al}_{11}\text{Re}_4$	$-34.5 \pm 1.5$

**Figure****Fig. 1. Al-Re.** Phase diagram [98 Hua].**References**

- [93 Mes] Meschel, S.V., Kleppa, O.J.: J. Alloys and Comp. **197** (1993) 75  
 [98 Hua] Huang, W., Chang Y.A.: J. Phase Equilibria **19** (1998) 361  
 [99 Cor] Cornish, L.A., Witcomb, W.J.: J. Alloys and Comp. **291** (1999) 117