

## Al – Cr (Aluminum – Chromium)

### Phase diagram

The system Al-Cr has been investigated (mostly partially) several times within the last years. There should be mentioned the experimental study by Costa Neto et al. [92 Cos], the discussion by Hayer [92 Hay], the review given by Audier et al. [95 Aud], the assessment by Murray [98 Mur] and the publication by Helander et al. [99 Hel]. Fig. 1 shows the phase diagram assessed by [98 Mur]. Fig. 2 is an enlarged version of the Al-rich part of this diagram. Optimized Gibbs energies have been calculated by [98 Mur]. The results were the basis for calculating the phase diagram plotted in Fig. 3.

Yamane et al. [94 Yam] have determined the solubility of Cr in Al in the neighbourhood of the melting temperature of Al. The results are given in Fig. 4.

### Crystal structure

Crystallographic data of intermediate phases are given in Table 1.

**Table 1. Al–Cr.** Crystal structure and lattice parameters of intermediate phases (mostly taken from [95 Aud]).

Phase	Structure	Prototype	Lattice parameters [nm]			Reference
			<i>a</i>	<i>b</i>	<i>c</i>	
θ - Al <sub>7</sub> Cr or Al <sub>13</sub> Cr <sub>2</sub>  or Al <sub>45</sub> Cr <sub>7</sub>	mon	Al <sub>45</sub> V <sub>7</sub>	2.5256	0.7582 $\beta = 128.68^\circ$	1.0955	[95 Aud]
Al <sub>5</sub> Cr	mon		1.2880	0.7652 $\beta = 122.33^\circ$	1.0639	[75 Ohn]
Al <sub>4</sub> Cr	mon		0.8716	2.3946 $\beta = 119.33^\circ$	1.6386	[75 Ohn]
Al <sub>9</sub> Cr <sub>4</sub>	cub		0.9123			[86 Kna]
Al <sub>8</sub> Cr <sub>5</sub> (h)	cub	Cu <sub>5</sub> Zn <sub>8</sub>	0.9090			[92 Bra]

By splat cooling it is possible to retain the high-temperature phase ( $\gamma_1$ ). Their lattice parameters are given in Fig. 5 and Fig. 6.

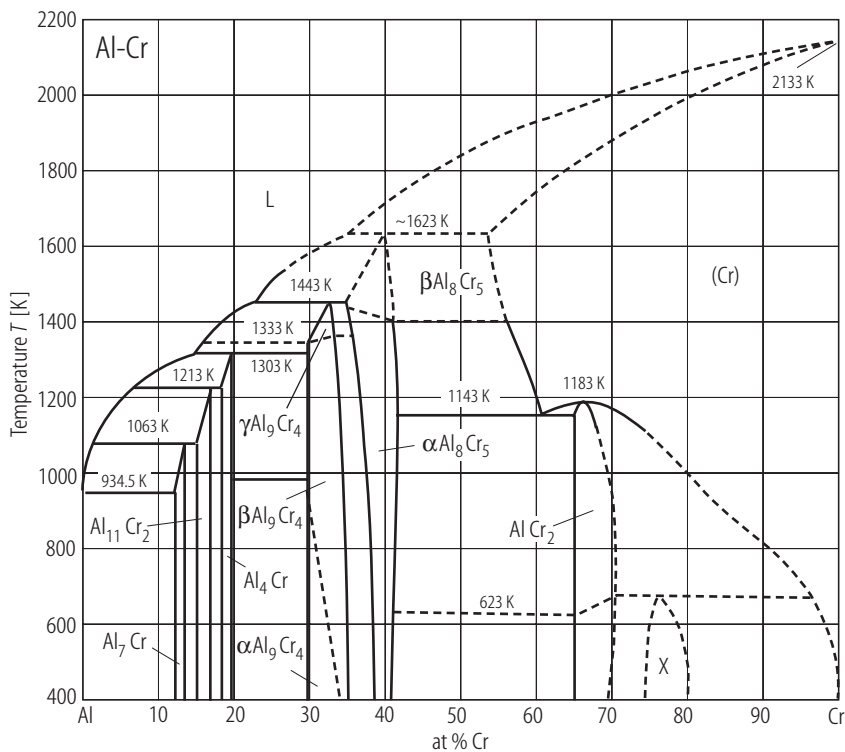
In these figures the average of the lattice constants (broken line) are plotted in comparison to Vegard's law (solid line). Helander et al. [99 Hel] found experimentally an ordered intermediate phase (at 39.2 at% Cr to 64.9 at% Cr and temperatures between 1158 K to 1274 K).

### Thermodynamics

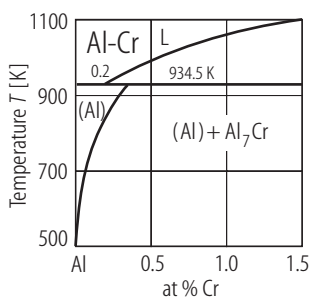
Meschel et al. [93 Mes] measured for Al<sub>8</sub>Cr<sub>5</sub> calorimetrically the standard enthalpy of formation:

$$\Delta H_{298}^S = -16.9 \pm 1.8 \text{ kJ g-atom}^{-1}$$

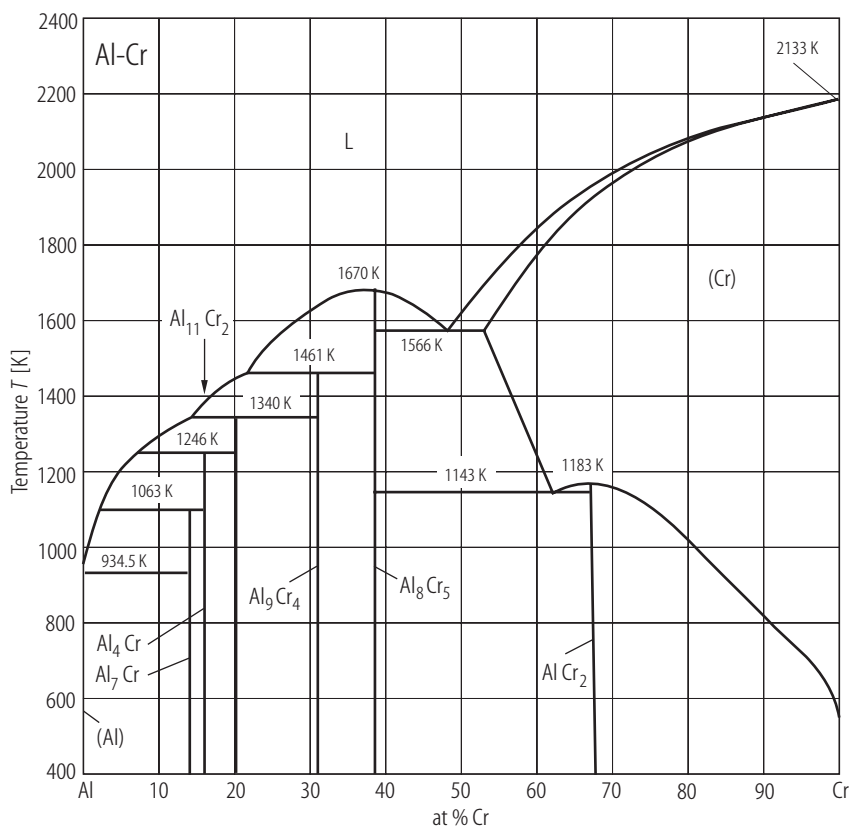
## Figures



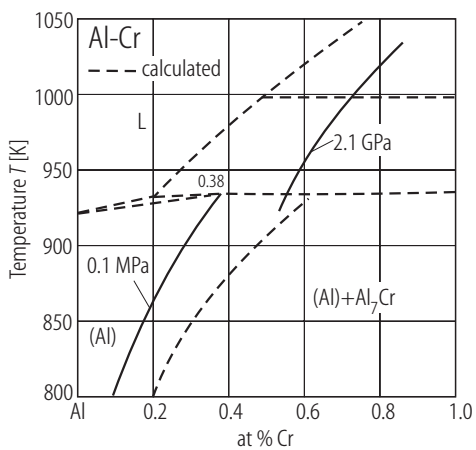
**Fig. 1. Al-Cr.** Phase diagram Al-Cr assessed by Murray [98 Mur].



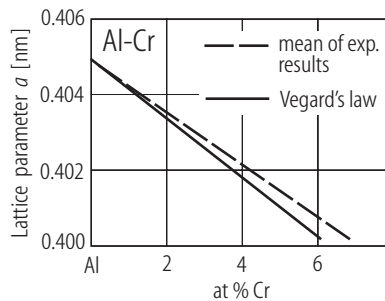
**Fig. 2. Al-Cr.** Enlarged version of the Al-rich part of the phase diagram Al-Cr taken from [98 Mur].



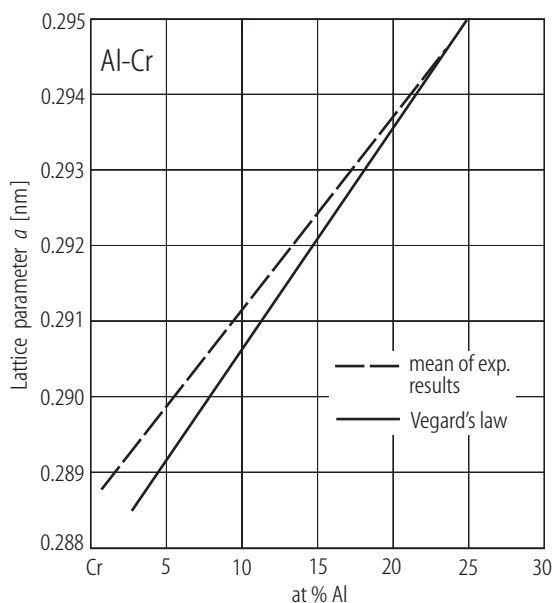
**Fig. 3.** Al-Cr. Phase diagram calculated by [98 Mur].



**Fig. 4.** Al-Cr. Solubility of Cr in Al [94 Yam].



**Fig. 5.** Al-Cr. Lattice parameters of (Al) (taken from [98 Mur]).



**Fig. 6. Al–Cr.** Lattice parameters of (Cr) (taken from [98 Mur]).

## References

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