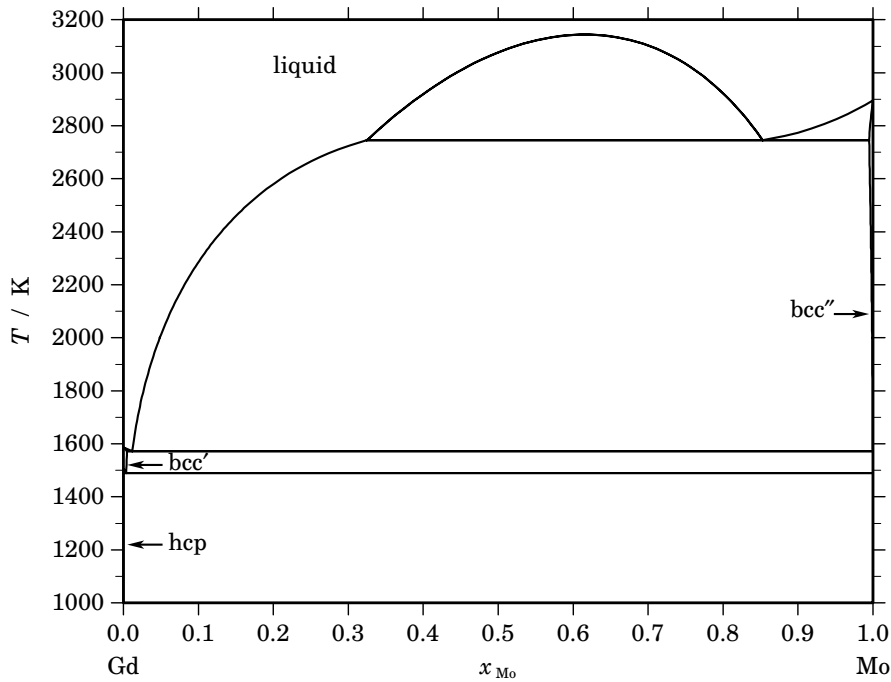


Gd – Mo (Gadolinium – Molybdenum)**Fig. 1.** Calculated phase diagram for the system Gd-Mo.

In the solid state Gd and Mo are almost insoluble in each other and no binary compounds are formed by them. The interest in this system is related to ternary and higher systems where intermetallic compounds are formed with interesting magnetic properties. The combination of gadolinium and molybdenum can also be encountered in Mo-containing stainless steel repositories for nuclear waste where Gd is added due to its high absorption cross section for thermal neutrons. The few experimental data on the Gd-Mo system consist of the temperature of the Gd-rich eutectic, the temperature and composition of the monotectic and the solubility of Gd in Mo [1966Chu]. Based on these data an optimised thermodynamic dataset of the Gd-Mo system has been reported in [2001Zin].

Table I. Phases, structures and models.

Phase	Strukturbericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	(Gd,Mo) ₁
bcc	A2	W	<i>cI2</i>	<i>Im$\bar{3}m$</i>	BCC_A2	(Gd,Mo) ₁
hcp	A3	Mg	<i>hP2</i>	<i>P6₃/mmc</i>	HCP_A3	(Gd,Mo) ₁

Table II. Invariant reactions.

Reaction	Type	<i>T</i> / K	Compositions / <i>x</i> _{Mo}			$\Delta_r H$ / (J/mol)
liquid \rightleftharpoons liquid' + liquid''	critical	3142.4	0.616	0.616	0.616	0
liquid'' \rightleftharpoons liquid' + bcc''	monotectic	2745.2	0.853	0.325	0.995	−34872
liquid'' \rightleftharpoons bcc' + bcc''	eutectic	1571.8	0.012	0.005	1.000	−10174
bcc' \rightleftharpoons hcp + bcc''	eutectoid	1489.4	0.004	0.000	1.000	−3759

Table IIIa. Integral quantities for the liquid phase at 3200 K.

x_{Mo}	ΔG_{m} [J/mol]	ΔH_{m} [J/mol]	ΔS_{m} [J/(mol·K)]	G_{m}^{E} [J/mol]	S_{m}^{E} [J/(mol·K)]	ΔC_P [J/(mol·K)]
0.000	0	0	0.000	0	0.000	0.000
0.100	−4887	3762	2.703	3762	0.000	0.000
0.200	−6338	6976	4.161	6976	0.000	0.000
0.300	−6719	9534	5.079	9534	0.000	0.000
0.400	−6578	11328	5.596	11328	0.000	0.000
0.500	−6192	12250	5.763	12250	0.000	0.000
0.600	−5714	12192	5.596	12192	0.000	0.000
0.700	−5207	11046	5.079	11046	0.000	0.000
0.800	−4610	8704	4.161	8704	0.000	0.000
0.900	−3591	5058	2.703	5058	0.000	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: Gd(liquid), Mo(liquid)

Table IIIb. Partial quantities for Gd in the liquid phase at 3200 K.

x_{Gd}	ΔG_{Gd} [J/mol]	ΔH_{Gd} [J/mol]	ΔS_{Gd} [J/(mol·K)]	G_{Gd}^{E} [J/mol]	S_{Gd}^{E} [J/(mol·K)]	a_{Gd}	γ_{Gd}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−2547	256	0.876	256	0.000	0.909	1.010
0.800	−4769	1168	1.855	1168	0.000	0.836	1.045
0.700	−6538	2952	2.966	2952	0.000	0.782	1.117
0.600	−7767	5824	4.247	5824	0.000	0.747	1.245
0.500	−8442	10000	5.763	10000	0.000	0.728	1.456
0.400	−8683	15696	7.619	15696	0.000	0.722	1.804
0.300	−8905	23128	10.010	23128	0.000	0.716	2.385
0.200	−10309	32512	13.382	32512	0.000	0.679	3.394
0.100	−17200	44064	19.145	44064	0.000	0.524	5.239
0.000	−∞	58000	∞	58000	0.000	0.000	8.846

Reference state: Gd(liquid)

Table IIIc. Partial quantities for Mo in the liquid phase at 3200 K.

x_{Mo}	ΔG_{Mo} [J/mol]	ΔH_{Mo} [J/mol]	ΔS_{Mo} [J/(mol·K)]	G_{Mo}^{E} [J/mol]	S_{Mo}^{E} [J/(mol·K)]	a_{Mo}	γ_{Mo}
0.000	−∞	40000	∞	40000	0.000	0.000	4.497
0.100	−25948	35316	19.145	35316	0.000	0.377	3.771
0.200	−12613	30208	13.382	30208	0.000	0.622	3.112
0.300	−7141	24892	10.010	24892	0.000	0.765	2.549
0.400	−4795	19584	7.619	19584	0.000	0.835	2.088
0.500	−3942	14500	5.763	14500	0.000	0.862	1.725
0.600	−3735	9856	4.247	9856	0.000	0.869	1.448
0.700	−3622	5868	2.966	5868	0.000	0.873	1.247
0.800	−3185	2752	1.855	2752	0.000	0.887	1.109
0.900	−2079	724	0.876	724	0.000	0.925	1.028
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Mo(liquid)

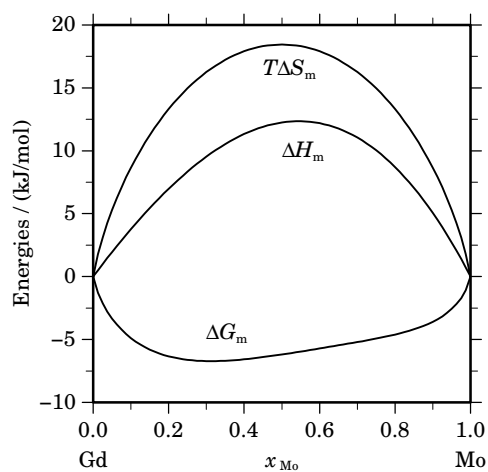


Fig. 2. Integral quantities of the liquid phase at $T=3200$ K.

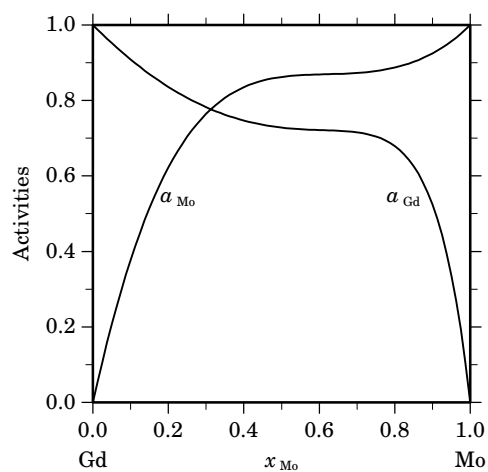


Fig. 3. Activities in the liquid phase at $T=3200$ K.

References

- [1966Chu] Y.-C. Chuang, C.-W. Li, H.-L. Chuang, L.-M. Kao: *Acta Metall. Sinica* **9** (1966) 110–112.
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