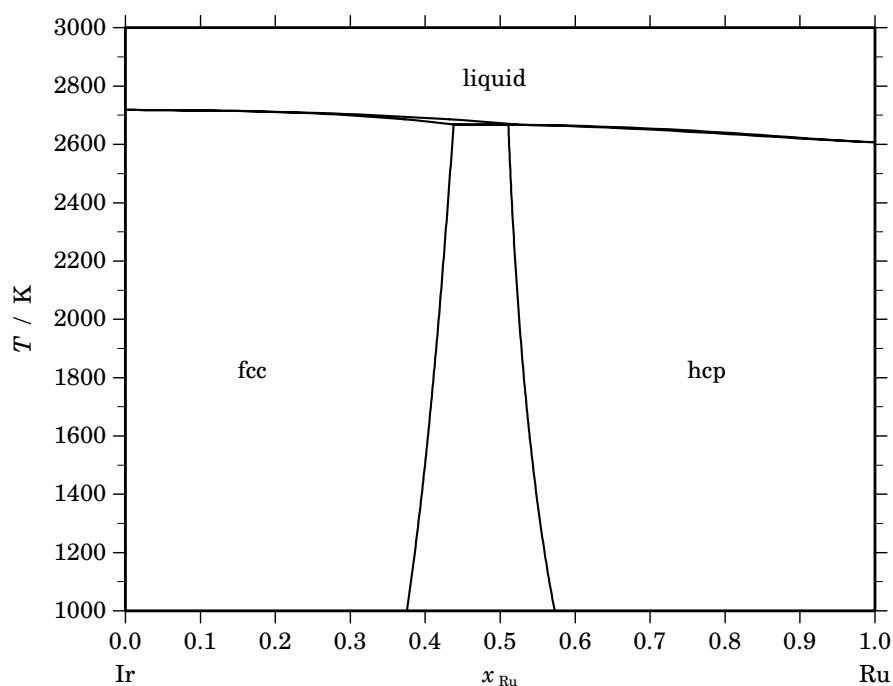


Ir – Ru (Iridium – Ruthenium)**Fig. 1.** Calculated phase diagram for the system Ir-Ru.

The Ir-Ru system exhibits the equilibrium phases liquid, Ir-rich fcc and Ru-rich hcp. The phase diagram was experimentally studied by [1964Rau] and [1988Ere] using thermal, X-ray, and metallographic investigations. Both studies are in good agreement. The fcc and hcp solvus boundaries as experimentally determined by Raub [1964Rau] and Eremenko *et al.* [1988Ere] are reproduced satisfactorily by the calculations. The solubility limit of Ir in hcp-Ru is 49 at.% at 2668 K [1988Ere]. The thermodynamic description of the Ir-Ru system was obtained by Korb [2004Kor]. The agreement between experimentally determined [1990Oka] and calculated phase diagrams is good for the solid-liquid range but at low temperature the two phase field between fcc and hcp appears a little wide.

Table I. Phases, structures and models.

Phase	Strukturbericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	(Ir,Ru) ₁
fcc	A1	Cu	<i>cF4</i>	<i>Fm$\bar{3}m$</i>	FCC_A1	(Ir,Ru) ₁
hcp	A3	Mg	<i>hP2</i>	<i>P6₃/mmc</i>	HCP_A3	(Ir,Ru) ₁

Table II. Invariant reactions.

Reaction	Type	<i>T</i> / K	Compositions / <i>x</i> _{Ru}			$\Delta_r H$ / (J/mol)
fcc + liquid \rightleftharpoons hcp	peritectic	2667.8	0.438	0.523	0.511	−73187

Table IIIa. Integral quantities for the liquid phase at 2800 K.

x_{Ru}	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	−8657	16154	8.861	−1089	6.158	0.000
0.200	−13504	28800	15.109	−1854	10.948	0.000
0.300	−16616	37839	19.448	−2395	14.369	0.000
0.400	−18439	43211	22.018	−2771	16.422	0.000
0.500	−19140	44895	22.869	−3003	17.106	0.000
0.600	−18741	42909	22.018	−3073	16.422	0.000
0.700	−17144	37311	19.448	−2923	14.369	0.000
0.800	−14108	28197	15.109	−2458	10.948	0.000
0.900	−9110	15702	8.861	−1542	6.158	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: Ir(liquid), Ru(liquid)

Table IIIb. Partial quantities for Ir in the liquid phase at 2800 K.

x_{Ir}	ΔG_{Ir} [J/mol]	ΔH_{Ir} [J/mol]	ΔS_{Ir} [J/(mol·K)]	G_{Ir}^{E} [J/mol]	S_{Ir}^{E} [J/(mol·K)]	a_{Ir}	γ_{Ir}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	−2634	1734	1.560	−182	0.684	0.893	0.992
0.800	−5770	7089	4.592	−575	2.737	0.780	0.976
0.700	−9344	16203	9.124	−1040	6.158	0.669	0.956
0.600	−13449	29098	15.195	−1556	10.948	0.561	0.935
0.500	−18354	45681	22.869	−2217	17.106	0.455	0.909
0.400	−24567	65737	32.252	−3235	24.633	0.348	0.870
0.300	−32969	88939	43.539	−4940	33.528	0.243	0.809
0.200	−45246	114841	57.174	−7777	43.792	0.143	0.716
0.100	−65917	142877	74.569	−12311	55.424	0.059	0.589
0.000	−∞	172369	∞	−19221	68.425	0.000	0.438

Reference state: Ir(liquid)

Table IIIc. Partial quantities for Ru in the liquid phase at 2800 K.

x_{Ru}	ΔG_{Ru} [J/mol]	ΔH_{Ru} [J/mol]	ΔS_{Ru} [J/(mol·K)]	G_{Ru}^{E} [J/mol]	S_{Ru}^{E} [J/(mol·K)]	a_{Ru}	γ_{Ru}
0.000	−∞	178655	∞	−12936	68.425	0.000	0.574
0.100	−62862	145932	74.569	−9256	55.424	0.067	0.672
0.200	−44442	115645	57.174	−6973	43.792	0.148	0.741
0.300	−33585	88323	43.539	−5556	33.528	0.236	0.788
0.400	−25925	64379	32.252	−4593	24.633	0.328	0.821
0.500	−19926	44109	22.869	−3789	17.106	0.425	0.850
0.600	−14857	27690	15.195	−2964	10.948	0.528	0.880
0.700	−10362	15184	9.124	−2059	6.158	0.641	0.915
0.800	−6323	6536	4.592	−1128	2.737	0.762	0.953
0.900	−2798	1571	1.560	−345	0.684	0.887	0.985
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Ru(liquid)

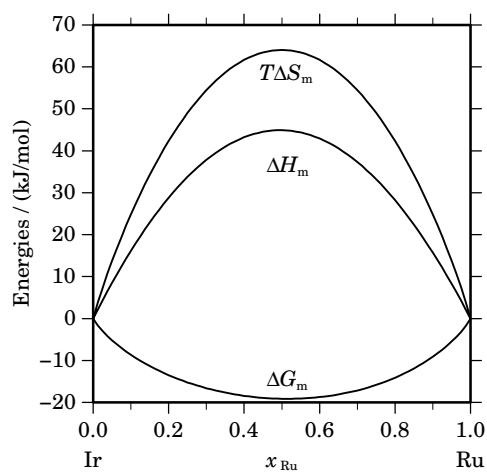


Fig. 2. Integral quantities of the liquid phase at $T=2800$ K.

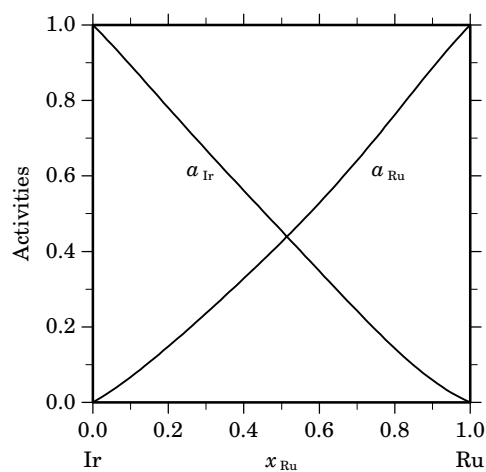


Fig. 3. Activities in the liquid phase at $T=2800$ K.

Table IVa. Integral quantities for the stable phases at 2000 K.

Phase	x_{Ru}	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)]
fcc	0.000	0	0	0.000	0	0.000	0.000
	0.100	-6202	-1073	2.565	-796	-0.138	0.000
	0.200	-9566	-1629	3.968	-1245	-0.192	0.000
	0.300	-11503	-1669	4.917	-1345	-0.162	0.000
	0.400	-12289	-1193	5.548	-1097	-0.048	0.000
	0.418	-12317	-1054	5.632	-1016	-0.019	0.000
hcp	0.525	-12389	-896	5.746	-884	-0.006	0.000
	0.600	-12201	-1090	5.556	-1010	-0.040	0.000
	0.700	-11182	-1154	5.014	-1024	-0.065	0.000
	0.800	-9181	-993	4.094	-860	-0.067	0.000
	0.900	-5924	-609	2.658	-519	-0.045	0.000
	1.000	0	0	0.000	0	0.000	0.000

Reference states: Ir(fcc), Ru(hcp)

Table IVb. Partial quantities for Ir in the stable phases at 2000 K.

Phase	x_{Ir}	ΔG_{Ir} [J/mol]	ΔH_{Ir} [J/mol]	ΔS_{Ir} [J/(mol·K)]	G_{Ir}^{E} [J/mol]	S_{Ir}^{E} [J/(mol·K)]	a_{Ir}	γ_{Ir}
fcc	1.000	0	0	0.000	0	0.000	1.000	1.000
	0.900	−1926	−258	0.834	−174	−0.042	0.891	0.990
	0.800	−4407	−1032	1.687	−696	−0.168	0.767	0.959
	0.700	−7498	−2323	2.588	−1566	−0.378	0.637	0.910
	0.600	−11279	−4129	3.575	−2785	−0.672	0.507	0.846
	0.582	−12039	−4507	3.766	−3040	−0.734	0.485	0.833
hcp	0.475	−12039	907	6.473	351	0.278	0.485	1.021
	0.400	−15632	−35	7.798	−395	0.180	0.391	0.977
	0.300	−21569	−1492	10.039	−1548	0.028	0.273	0.911
	0.200	−29643	−3173	13.235	−2879	−0.147	0.168	0.841
	0.100	−42678	−5078	18.800	−4388	−0.345	0.077	0.768
	0.000	−∞	−7208	∞	−6074	−0.567	0.000	0.694

Reference state: Ir(fcc)

Table IVc. Partial quantities for Ru in the stable phases at 2000 K.

Phase	x_{Ru}	ΔG_{Ru} [J/mol]	ΔH_{Ru} [J/mol]	ΔS_{Ru} [J/(mol·K)]	G_{Ru}^{E} [J/mol]	S_{Ru}^{E} [J/(mol·K)]	a_{Ru}	γ_{Ru}
fcc	0.000	−∞	−13306	∞	−9705	−1.801	0.000	0.558
	0.100	−44688	−8403	18.142	−6398	−1.003	0.068	0.681
	0.200	−30202	−4016	13.093	−3439	−0.288	0.163	0.813
	0.300	−20849	−145	10.352	−828	0.342	0.285	0.951
	0.400	−13803	3210	8.506	1434	0.888	0.436	1.090
	0.418	−12705	3757	8.231	1803	0.977	0.466	1.115
hcp	0.525	−12705	−2525	5.090	−2000	−0.263	0.466	0.887
	0.600	−9914	−1793	4.061	−1420	−0.187	0.551	0.918
	0.700	−6730	−1009	2.861	−799	−0.105	0.667	0.953
	0.800	−4066	−448	1.809	−355	−0.047	0.783	0.979
	0.900	−1841	−112	0.864	−89	−0.012	0.895	0.995
	1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: Ru(hcp)

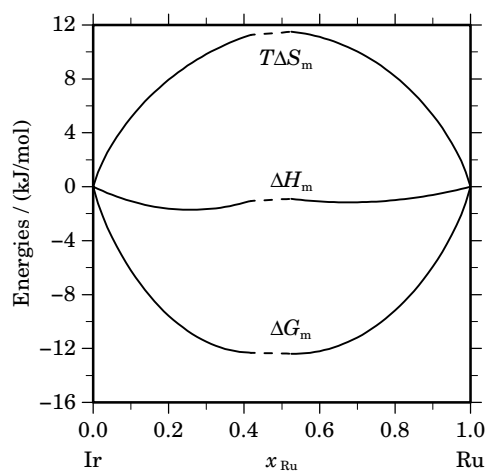


Fig. 4. Integral quantities of the stable phases at $T=2000$ K.

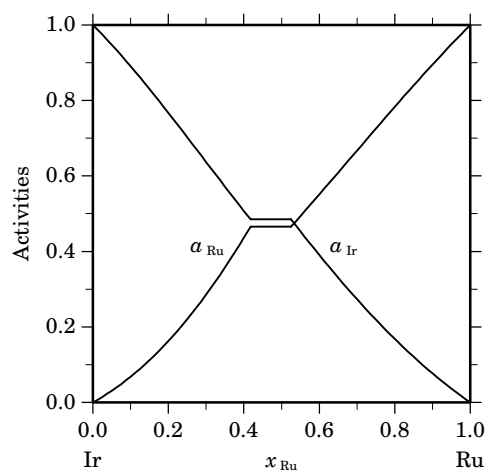


Fig. 5. Activities in the stable phases at $T=2000$ K.

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