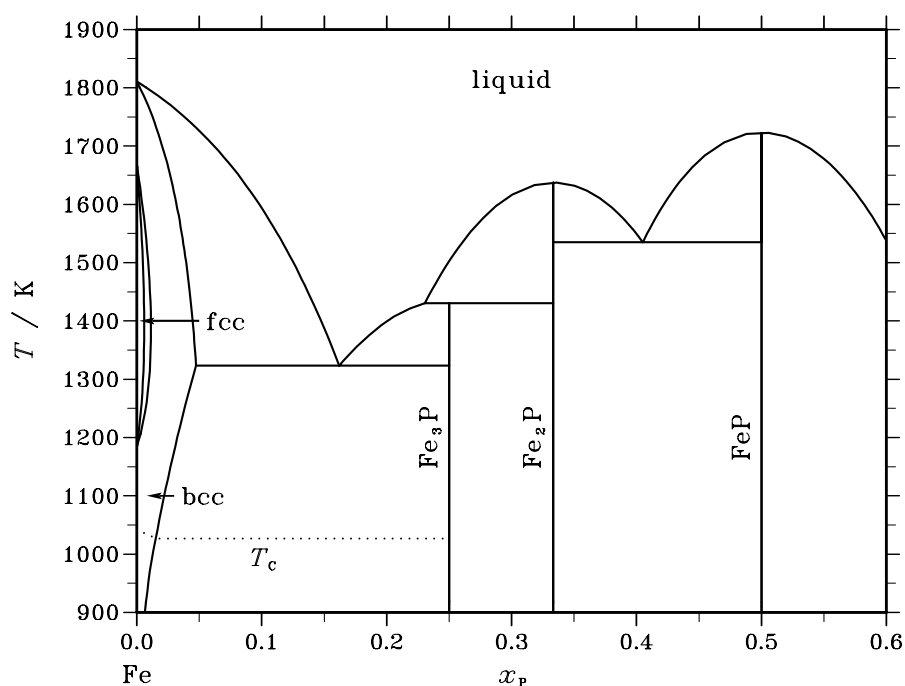


Fe – P (Iron – Phosphorus)**Fig. 1.** Calculated phase diagram for the system Fe-P.

The diagram presented does not include the gas phase and is thus metastable on the P-rich side. The solubility of P in the iron phases are a few atomic percent and P is a bcc stabiliser. There are 3 phosphides stable, Fe_3P , Fe_2P and FeP . P is sometimes added to iron to enable liquid sintering but in most cases the content of P is kept at a very low level. The assessment presented here [99Lee] includes all relevant information.

Table I. Phases, structures and models.

Phase	Strukturbericht	Prototype	Pearson symbol	Space group	SGTE name	Model
liquid					LIQUID	$(\text{Fe,P})_1$
fcc	A1	Cu	$cF4$	$Fm\bar{3}m$	FCC_A1	$(\text{Fe,P})_1$
bcc	A2	W	$cI2$	$Im\bar{3}m$	BCC_A2	$(\text{Fe,P})_1$
Fe_3P	$D0_e$	Ni_3P	$tI32$	$I\bar{4}$	FE3P1	Fe_3P_1
Fe_2P	$C22$	Fe_2P	$hP9$	$P\bar{6}2m$	FE2P1	Fe_2P_1
FeP}$	...	...	oP8$	$Pna2_1$	FEP	Fe_1P_1
P(red)	...	...	...	...	P_RED	P_1
αP	...	αP	c^{**}	...	P_WHITE	P_1

Table II. Invariant reactions.

Reaction	Type	T / K	Compositions / x_{P}			$\Delta_{\text{r}}H / (\text{J/mol})$
liquid \rightleftharpoons FeP	congruent	1723.2	0.500	0.500		–15100
liquid \rightleftharpoons Fe ₂ P	congruent	1637.2	0.333	0.333		–15211
liquid \rightleftharpoons Fe ₂ P + FeP	eutectic	1535.3	0.405	0.333	0.500	–12984
liquid + Fe ₂ P \rightleftharpoons Fe ₃ P	peritectic	1430.7	0.231	0.333	0.250	–14257
liquid \rightleftharpoons bcc + Fe ₃ P	eutectic	1323.7	0.162	0.047	0.250	–12445

Table IIIa. Integral quantities for the liquid phase at 1823 K.

x_{P}	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	–14358	–17598	–1.778	–9430	–4.481	0.000
0.200	–24565	–33617	–4.965	–16981	–9.126	0.000
0.300	–31450	–46009	–7.986	–22191	–13.065	0.000
0.400	–35018	–53397	–10.082	–24817	–15.678	0.000
0.500	–35338	–55075	–10.827	–24831	–16.590	0.000
0.600	–32627	–51006	–10.082	–22426	–15.678	0.000
0.700	–27266	–41825	–7.986	–18007	–13.065	0.000
0.800	–19784	–28835	–4.965	–12199	–9.126	0.000
0.900	–10771	–14012	–1.778	–5844	–4.481	0.000
1.000	0	0	0.000	0	0.000	0.000

Reference states: Fe(liquid), P(liquid)

Table IIIb. Partial quantities for Fe in the liquid phase at 1823 K.

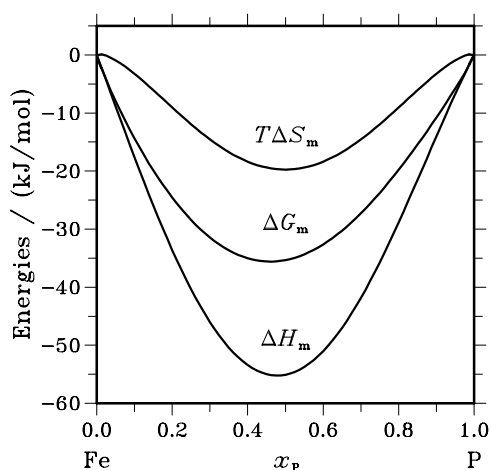
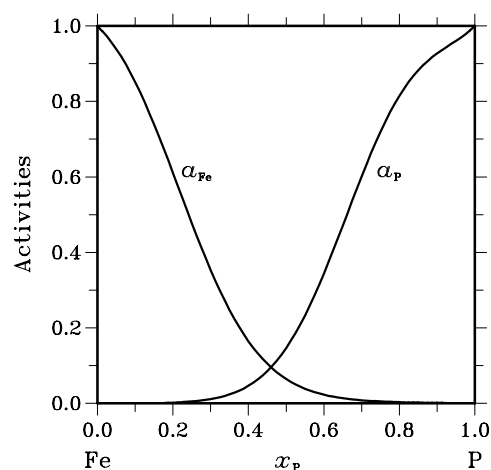
x_{Fe}	ΔG_{Fe} [J/mol]	ΔH_{Fe} [J/mol]	ΔS_{Fe} [J/(mol·K)]	G_{Fe}^{E} [J/mol]	S_{Fe}^{E} [J/(mol·K)]	a_{Fe}	γ_{Fe}
1.000	0	0	0.000	0	0.000	1.000	1.000
0.900	–2442	–393	1.124	–845	0.248	0.851	0.946
0.800	–7485	–4636	1.563	–4103	–0.292	0.610	0.763
0.700	–15775	–15818	–0.023	–10369	–2.989	0.353	0.505
0.600	–27332	–35017	–4.215	–19590	–8.463	0.165	0.275
0.500	–41564	–61301	–10.827	–31057	–16.590	0.064	0.129
0.400	–57304	–91726	–18.882	–43416	–26.500	0.023	0.057
0.300	–72904	–121336	–26.567	–54655	–36.577	0.008	0.027
0.200	–86512	–143167	–31.078	–62117	–44.459	0.003	0.017
0.100	–97391	–148241	–27.893	–62490	–47.038	0.002	0.016
0.000	– ∞	–125571	∞	–51812	–40.460	0.000	0.033

Reference state: Fe(liquid)

Table IIIc. Partial quantities for P in the liquid phase at 1823 K.

x_P	ΔG_P [J/mol]	ΔH_P [J/mol]	ΔS_P [J/(mol·K)]	G_P^E [J/mol]	S_P^E [J/(mol·K)]	a_P	γ_P
0.000	$-\infty$	-175379	∞	-101620	-40.460	0.000	0.001
0.100	-121598	-172448	-27.893	-86697	-47.038	0.000	0.003
0.200	-92887	-149542	-31.078	-68493	-44.459	0.002	0.011
0.300	-68023	-116455	-26.567	-49774	-36.577	0.011	0.037
0.400	-46546	-80967	-18.882	-32657	-26.500	0.046	0.116
0.500	-29112	-48849	-10.827	-18605	-16.590	0.147	0.293
0.600	-16175	-23860	-4.215	-8433	-8.463	0.344	0.573
0.700	-7707	-7749	-0.023	-2300	-2.989	0.601	0.859
0.800	-3102	-252	1.563	280	-0.292	0.815	1.019
0.900	-1147	902	1.124	450	0.248	0.927	1.030
1.000	0	0	0.000	0	0.000	1.000	1.000

Reference state: P(liquid)

**Fig. 2.** Integral quantities of the liquid phase at $T=1823$ K.**Fig. 3.** Activities in the liquid phase at $T=1823$ K.**Table IV.** Standard reaction quantities at 298.15 K for the compounds per mole of atoms.

Compound	x_P	$\Delta_f G^\circ$ / (J/mol)	$\Delta_f H^\circ$ / (J/mol)	$\Delta_f S^\circ$ / (J/(mol·K))	$\Delta_f C_P^\circ$ / (J/(mol·K))
Fe ₃ P ₁	0.250	-39416	-41002	-5.322	-0.968
Fe ₂ P ₁	0.333	-47891	-49753	-6.244	-1.151
Fe ₁ P ₁	0.500	-56177	-59167	-10.028	-1.519

References

[99Lee] B.-J. Lee: unpublished assessment, 1999.