METMAT

TERMODINÂMICA DAS SOLUÇÕES

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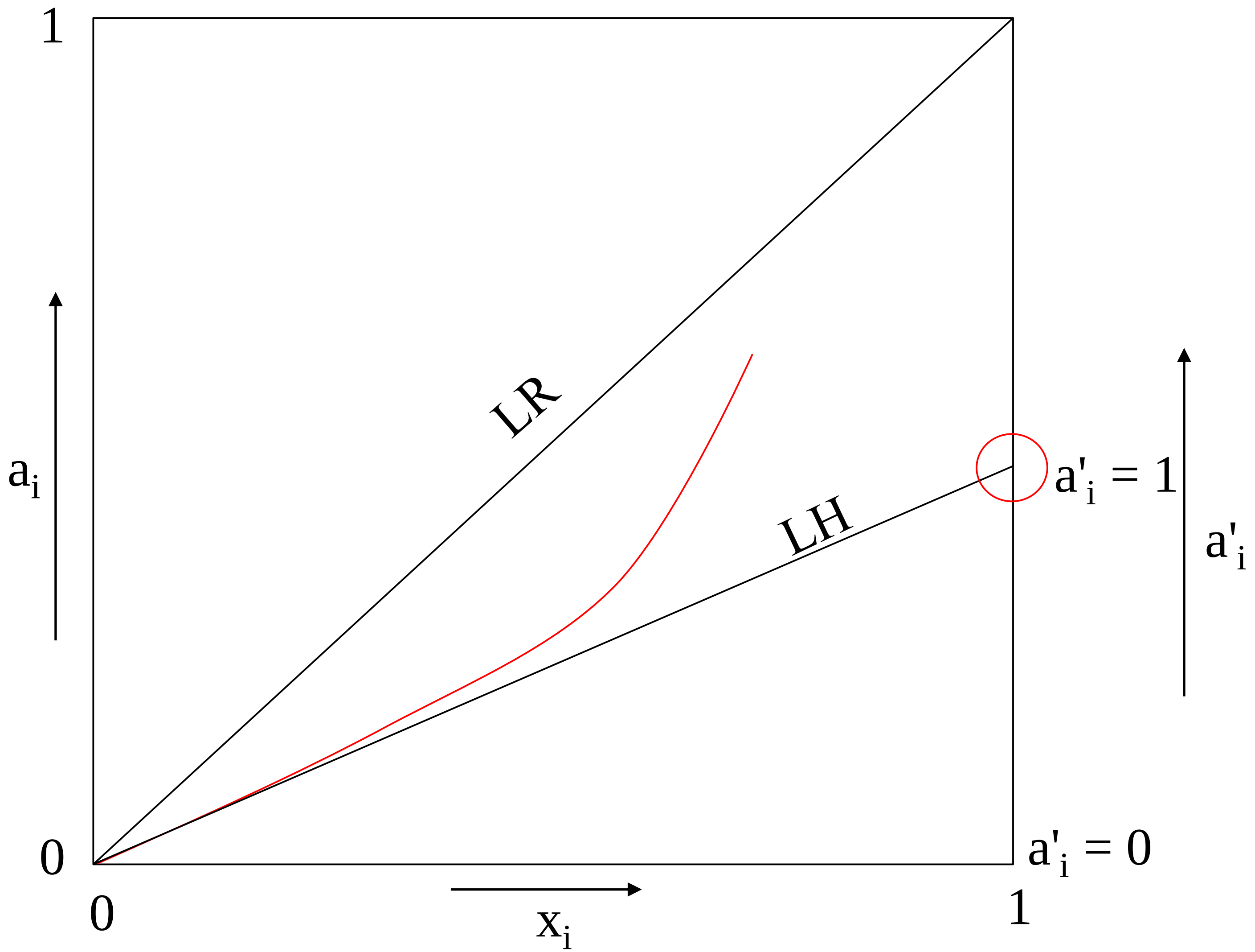
ESCALA HENRIANA- 1molar



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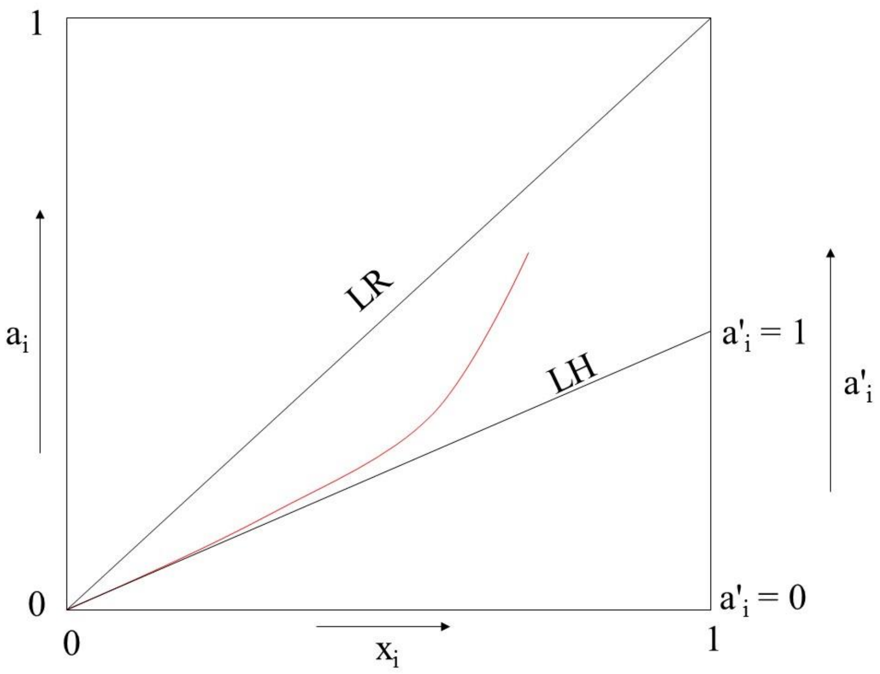

$$a_i^{'} = \frac{x_i . P_{Total}}{x_i^{x=1} . P_{Total}} = \frac{x_i}{x_i^{x=1}} = x_i$$

$$a_i^{x=1} = \frac{p_i}{p_i^{x=1}} = a_i^{'}$$

$$\mathbf{a_i^{'} = x_i}$$

Válida a LH

i_{puro} = $\underline{i}_{1\%}$

$$K = \frac{h_i}{a_i} = \frac{\%i}{\gamma_i . X_i}$$

Se válida a lei de Henry no intervalo de composição considerado:

- $X_i = \frac{\%i.M_{solvente}}{100.M_i}$
- **%i=1**

$$K = \frac{100.M_i}{\gamma_i^o.M_{solvente}}$$

j = solvente

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$$X_i = \frac{n_i}{n_j + n_i} = \frac{\frac{m_i}{M_i}}{\frac{m_j}{M_j} + \frac{m_i}{M_i}} = \frac{\frac{\%i}{M_i}}{\frac{\%j}{M_j} + \frac{\%i}{M_i}}$$

$$Para\ \%i \rightarrow 0\% \Rightarrow\ \%j \rightarrow 100\%$$

$$X_i = \frac{\frac{\%i}{M_i}}{\frac{100}{M_j} + \frac{0}{M_i}} = \frac{\frac{\%i}{M_i}}{\frac{100}{M_j}}$$

$$X_i = \frac{\%i . M_{solvente}}{100 . M_i}$$

$i_{puro} = \underline{i}_{1\%}$

$$\Delta G^o_{R\rightarrow h(1\%)} = R.T\ln(\frac{\gamma_i^o.M_j}{100.M_i})$$

Se $\ln\gamma^o = A + B/T$

$$\Delta G^o_{R\rightarrow h(1\%)} = B.R + R.T\ln(\frac{A.M_j}{100.M_i})$$

$$\Delta H^o_{R\rightarrow h(1\%)} = B.R$$

$$\Delta S^o_{R\rightarrow h(1\%)} = -R\ln(\frac{A.M_j}{100.M_i})$$

$i_{puro} = i_{X=1}$

$$\Delta G^{o}_{R \to h\ (X=1)} = R.T \ln(\gamma_i^{o})$$

Se $\ln\gamma^{o} = A + B/T$

$$\Delta G^{o}_{R \to h\ (X=1)} = B.R + R.T.A$$

$$\Delta H^{o}_{R \to h\ (X=1)} = B.R$$

$$\Delta S^{o}_{R \to h\ (X=1)} = -A.R$$

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ESCALA HENRIANA

$i_{raoultiano} = i_{henriano}$

Element, i†	γ_i^0(1873)*	M (pure) = M(*i.d.*, X, liq.) $\Delta G(x)$, cal/g atom	M (pure) = M(*i.d.*, wt.-%, liq.) $\Delta G(\%)$, cal/g atom	Ref. and Notes
Ag (*l*)	200	19 700	19 700 − 10·46T	11, 2; from solubility data, regular solution is assumed.
Al (*l*)	0·029	−15 100 + 1·03T	−15 100 − 6·67T	19
B (*s*)	0·022	−15 600 + 0·71T	−15 600 − 5·15T	29: from solubility of BN, using values for nitrogen given below.
C (*gr*)	0·57	5 400 − 4·0T	5 400 − 10·1T	42, 2
Ca (*v*)	2240	− 9 430 + 20·3T	− 9 430 + 11·8T	20; from solubility data, regular solution is assumed.
Co (*l*)	1·07	240	240 − 9·26T	82, 2; regular solution is assumed.
Cr (*l*)	1·0	0	− 9·01T	87, 86, 88, 89; liquid Fe–Cr alloys ideal at low Cr concentration.
Cr (*s*)	1·14	4 600 − 2·19T	4 600 − 11·20T	
Cu (*l*)	8·6	8 000	8 000 − 9·41T	93, 2
1/2 H_2 (g)	—	—	8 720 + 7·28T	95, 96, 2; $\Delta G°$(ppm) = 8,720–11·02T
Mn (*l*)	1·3	976	976 − 9·12T	125, 126, 2
Mo (*l*)	1	0	− 10·23T	Ideal behaviour assumed.
Mo (*s*)	1·86	6 600 − 2·29T	6 600 − 12·52T	Ideal behaviour of liquid solution, transfer of standard state.
1/2 N_2 (g)	—	—	860 + 5·71T	135
Nb (*l*)	1·0	0	− 10·2	See Mo above.
Nb (*s*)	1·4	5 500 − 2·3T	5 500 − 12·5	
Ni (*l*)	0·66	− 5 000 + 1·80T	− 5 000 − 7·42T	164, 2
1/2 O_2 (g)	—	—	−28 000 − 0·69T	168
1/2 P_2 (g)	—	—	−29 200 − 4·6T	218
Pb (*l*)	1400	50 800 − 12·7T	50 800 − 25·4T	21; calculated from data on solubility.
1/2 S_2 (g)	—	—	−32 280 + 5·6T	72
Si (*l*)	0·0013	−31 430 + 3·64T	−31 430 − 4·12T	16, 243
Sn (*l*)	2·8	3 820	3 820 − 10·62T	244; regular solution assumed.
Ti (*l*)	0·037	−11,100	−11 000 − 8.85T	19; regular solution assumed.
Ti (*s*)	0·038	− 7 440 − 1·90T	− 7 440 − 10·75T	19
U (*l*)	0·027	−13 400	−13 400 − 12·0T	24; regular solution assumed.
V (*l*)	0·08	−10 100 + 0·37T	−10 100 − 8·6T	28
V (*s*)	0·1	− 4 950 − 1·93T	− 4 950 − 10·9T	
W (*l*)	1	0	− 11·5T	Assumed ideal liquid solution.
W (*s*)	1·2	+ 7 500 − 3·65T	+ 7 500 − 15·2T	
Zr (*l*)	0·037	−12 200	−12 200 − 10·13T	γ^0_{Zr} assumed equal to γ^0_{Ti}, and regular solution assumed.
Zr (*s*)	0·043	− 8 300 − 1·82T	− 8 300 − 11·95T	

* $\gamma_i^0 = \lim_{X_i \to 0} a_i/X_i$

† The letters in parentheses indicate the standard states used. All are of one atmosphere pressure.

1 cal = 4·18 J

Determinar a atividade raoultiana do silício numa liga líquida Fe-Si a 1600ºC contendo 1%Si. Admitir válida a lei de Henry para o Si.

$$\{Si\} = \underline{Si} \qquad \Delta G^\circ = -31430 - 4{,}12T \ \ (cal/mol)$$

$$\Delta G^\circ = -3{,}91x10^4 \, cal/mol$$

$$K = \frac{h_{Si}}{a_{Si}} = \frac{1}{a_{Si}} = 3{,}7x10^4$$

$$a_{Si} = 2{,}7x10^{-5}$$