South Dakota School of Mines and Technology
Department of Materials and Metallurgical Engineering

Met 426/526 Homework

1. Plot the activity of C in austenite relative to pure solid graphite as a function of both mole fraction and wt % C. (To do this in Excel, one must make the mole fraction and the wt % the vertical scale and activity the horizontal scale.)

2. Compute for each mole fraction for which activity data is tabulated in Hultgren, et al. the corresponding value of f_C and wt % C. Place the results in the table below.

Selected Solution Values for C in Austenite at 1426 K

x_C	wt % C	a_C	γ_C	h_C	f_C	e^C_C
0.00		0.000	4.894			
0.01		0.053	5.323			
0.02		0.116	5.800			
0.03		0.190	6.323			
0.04		0.276	6.911			
0.05		0.378	*7*.570			
		(±0.028)	(±0.570)			
0.06		0.499	8.309			
0.07		0.638	9.121			
0.08		0.805	10.064			
0.09*		1.000	11.111			

*Phase boundary

3. Construct a plot of h_C vs. wt %C.

4. Why is $f_C>1$ when $\gamma_C>1$? [Normally, when $\gamma_i>1$, $f_i<1$; when $\gamma_i<1$, $f_i>1$ and when $\gamma_i=1$, $f_i=1$.]

5. Estimate the value of the self-interaction coefficient of carbon.

Selected Thermodynamic Values for C Component in γ-Fe at 1426 K

C= $\underline{C}$ (in alloy)

x_C	a_C	γ_C	G^M_C	G^{xs}_C	H^M_C	S^M_C	S^{xs}
0.00	0.000	4.894		4500	10552		4.244
0.01	0.053	5.323	-8312	4738	10729	13.353	4.201
0.02	0.116	5.800	-6105	4981	10910	11.932	4.158
0.03	0.190	6.323	-4710	5226	11094	11.083	4.115
0.04	0.276	6.911	-3643	5478	11282	10.466	4.070
0.05	0.378	*7*.570	-2753	5736	11474	9.977	4.024
	(±0.028)	(±0.570)	(±200)	(±200)	(±500)	(±0.380)	(±0.380
0.06	0.499	8.309	-1973	6000	11671	9.568	3.977
0.07	0.638	9.121	-1267	6268	11871	9.213	3.929
0.08	0.805	10.064	-614	6543	12076	8.899	3.880
0.09*	1.000	11.111	0	6823	12285	8.615	3.830

*Phase boundary

Source - Ralph Hultgren, Pramod Desai, Donald Hawkins, Molly Gleiser, and Kenneth Kelley: **Selected Values of Thermodynamic Properties of Binary Alloys**, ASM, Metal Park, OH, 1973.