

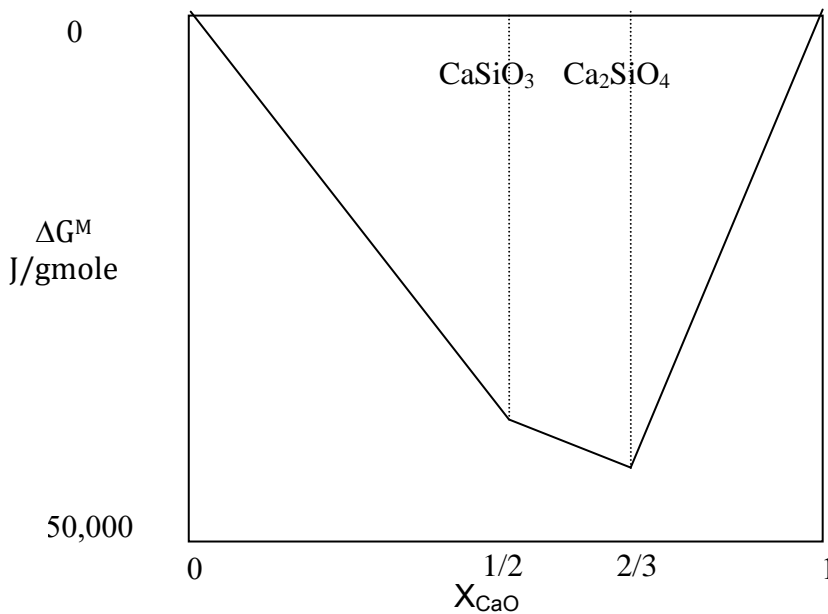
**SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY  
DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING**

Met 426/526

Final Exam

5/4/09

1. To avoid paying patent royalties for measuring oxygen potentials, XYZ Steel decided to use a Mo/MoO<sub>2</sub> reference electrode. What cell potential would one expect at 1873 K while using such a device for a steel containing 0.005 [wt %O]?
2. Hot metal from the BF operating at 1500 °C contains 0.4 wt % Mn. What wt % Mn would be expected in the slag with the following composition: CaO = 50%, MgO = 10%, and SiO<sub>2</sub> = 40%.
3. If 200 tons of the hot metal from problem #2 undergoes BOF refining at 1650 °C with 20 tons of slag having a B = 3.0, what would be the final [wt %Mn]?
4. What are the major reactions that control the deposition of C at the steel surface during carburization?
5. Knowing that the slope-intercept method applied to a integral molar Gibbs energy of mixing diagram will give the partial molar Gibbs energies [RTln(a<sub>i</sub>) 's], estimate the activity of SiO<sub>2</sub> (relative to pure, solid SiO<sub>2</sub>) in the compound CaOSiO<sub>2</sub> from the following Gibbs energy of mixing for CaO and SiO<sub>2</sub>. T=1813 K (the melting point of CaSiO<sub>3</sub>)



6. How much argon (STP) would be required to remove 90% of all of the dissolved oxygen from a 1040 rimming steel at 1873?
7. Show how to compute the C + CO<sub>2</sub> = 2 CO line on the Fe-O-C Diagram.