Department of Materials Science and Engineering
Pohang University of Science and Technology

AMSE502 Phase Transformations

due Date: Mar. 21, 2023

Problem Set #1

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1. Write an expression for the Gibbs energy (for one mole of formula unit) for an Fe-M-C ternary FCC solution phase using a formula unit, $(Fe,M)_1(va,C)_1$, and derive the expression for the chemical potential for carbon. Confirm that you are obtaining the following expression.

$$\mu_C = -y_{Fe}{}^{\circ}G_{Fe:Va} - y_M{}^{\circ}G_{M:Va} + y_{Fe}{}^{\circ}G_{Fe:C} + y_M{}^{\circ}G_{M:C}$$
$$- RT\ln(1-y_C) + RT\ln y_C$$
$$- y_{Fe}y_M L_{Fe,M:Va} + y_{Fe}y_M L_{Fe,M:C}$$
$$+ (1-2y_C)y_{Fe}L_{Fe:C,Va} + (1-2y_C)y_M L_{M:C,Va}$$

2. Choose one between the following two papers, read and summarize on one A4 paper.

- "Size dependency of melting point of crystalline nano particles and nano wires: A thermodynamic modeling," Eun-Ha Kim and Byeong-Joo Lee, Metals and Materials International 15, 531-537 (2009).

- "Thermodynamic Analysis for the Size-Dependence of $Si_{1-x}Ge_x$ Nanowire Composition Grown by a Vapor-Liquid-Solid Method," Inyoung Sa, Byeong-Moon Lee, Cheol-Joo Kim, Moon-Ho Jo and Byeong-Joo Lee, CALPHAD 32, 669-674 (2008).