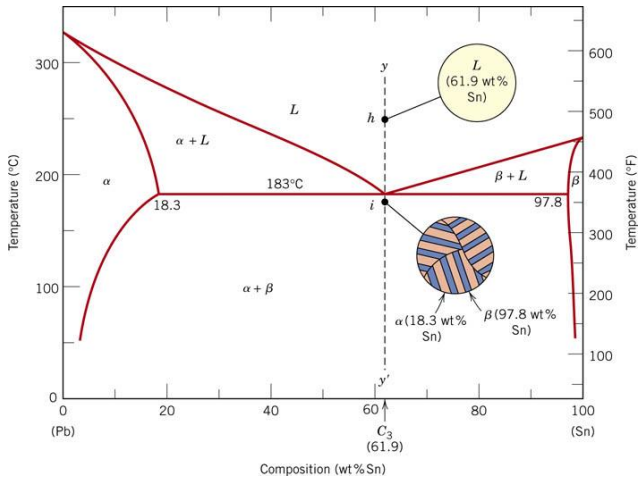
Indian Institute of Technology Roorkee
Department of Metallurgical and Materials Engineering

MT-105 Electrical and Electronic Materials

Assignment 2

1. **Consider 50% Pb- 50% Sn solder alloy:**



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i. Sketch the microstructure of the alloy at various stages as it is cooled from the melt. What is the importance of this alloy in electrical applications?

ii. At what temperature does the solid melt? What is the significance of this temperature?

iii. What is the temperature range over which the alloy is a mixture of melt and solid? What is the microstructure of the solid?

iv. Consider the solder at room temperature following cooling from 183^0C. Assume that the rate of cooling from 183^0C to room temperature is faster than the atomic diffusion rates needed to change the compositions of the **α** and **β** phases in the solid. Assuming the alloy is 1 kg. Calculate the masses of the following components in the solid.

a) The primary **α** (proeutectic)**,** b) **α** in the whole alloy, c) **α** in the eutectic solid and

d) **β** in the alloy (where is the **β** phase?)

e) For Pb-40Sn, find the degree of freedom at,

i) liquid region, ii) liquidus, iii) two phase mushy region, iv) solidus and v) at room temperature.

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2. i. Consider a multicomponent alloy containing N elements. If w_1, w_2, w_3,…..,w_N are the weight fractions of the components 1, 2, 3, …..,N in the alloy and M_1, M_2, M_3,……..,M_N are the respective atomic masses of the elements, show that the atomic fraction of the i^{th} component is given by,

$$n_i = \frac{w_i / M_i}{w_1/M_1 + w_2/M_2 + \text{----------} + w_N/M_N}$$

ii. Consider the semiconducting II-VI compound cadmium selenide, CdSe. Given the atomic masses of Cd and Se, find the weight fraction of Cd and Se in the compound and grams of Cd and Se needed to make 100 grams of CdSe.