

國立成功大學
110學年度碩士班招生考試試題

編 號：84

系 所：資源工程學系

科 目：材料科學導論

日 期：0202

節 次：第 3 節

備 註：可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

- Suppose that interstitial atoms are found to move from one site to another at the rates of 5×10^8 jumps/s at 500°C and 8×10^{10} jumps/s at 800°C . Calculate the activation energy Q for the process. (10%)
- Draw (a) the $[1 -2 1]$ direction and (b) the (-210) plane in a cubic unit cell. (10%)
- Determine (a) the solubility of tin in solid lead at 100°C , (b) the maximum solubility of lead in solid tin, (c) the amount of β that forms if a Pb-10% Sn alloy is cooled to 0°C , (d) the masses of tin contained in the α and β phases, and (e) the mass of lead contained in the α and β phases. Assume that the total mass of the Pb-10% Sn alloy is 100 grams. The phase diagram we need is shown in Fig. 1. All percentages shown are weight %. (10%)

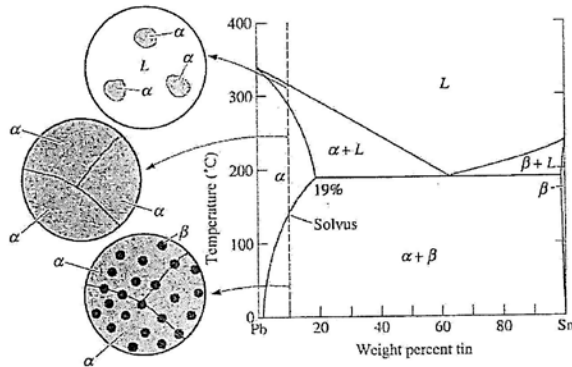


Fig.1 Sn-Pb phase diagram.

- Silicon carbide particles are compacted and fired at a high temperature to produce a strong ceramic shape. The specific gravity of SiC is 3.2 g/cm^3 . The ceramic shape subsequently is weighed when dry (360 g), after soaking in water (385 g), and while suspended in water (224 g). Calculate the apparent porosity, bulk density, the true porosity, and the fraction of the pore volume that is closed. (20%)
- Barium titanate (BaTiO_3) is a ceramic material used to make capacitors that store electrical charge. The lattice constant for the cubic crystal structure is to be determined. This material was analyzed using copper K- α radiation of wavelength 1.54 angstrom. It was seen that the value of 2θ at which the (111) reflection from the diffracted x-rays was at 39° . What is the lattice constant a_0 for the cubic form of BaTiO_3 ? (10%)
- Please identify the crystal systems for the point groups of 2, 422, 23, $mm2$, 3m. (20%)
- Please explain the kinds of intrinsic point defects in Al_2O_3 and write the possible defect reaction equations for the substitution of MgO for Al_2O_3 . (20%)