國立高雄大學 107 學年度研究所碩士班招生考試試題

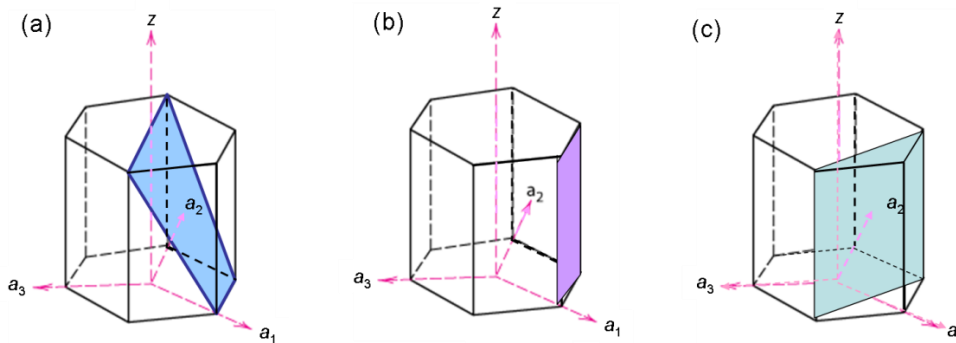科目：材料科學導論
考試時間：100 分鐘

系所：化學工程及材料工程學系
(無組別)   是否使用計算機：是
本科原始成績：100 分

1.(5%) Write down the relationships of cell axises and interaxial angles of Hexagonal and Orthorhombic crystal system, respectively. Sketch their unit cell geometries.

2. (5%) Determine the Miller indices for the three planes shown in the following hexagonal unit cells:

3.(5%) Estimate the maximum and minimum thermal conductivity values for a cermet that contains 80 vol.% titanium carbide (TiC) particles in a nikel matrix. Assume thermal conductivities of 27 and 67 W/m-K for TiC and Ni, respectively. (10%)

4. (10%) Introduce different types of point, linear, and planar defects in materials by figures and words.

5. (10 %) Plot a stress-strain diagram of general metal materials and explain the meaning of elastic modulus, yield strength, tensile strength, fracture strength, ductility, and toughness.

6. (10%) List four strategies for materials hardening and explain the mechanisms involved.

7. (15 %) The figure below shows the Fe-Fe_3C phase diagram. Consider 2.0 kg of austenite containing 0.36wt % C , cooled to 726℃.

 (a) How many kilograms of ferrite and cementite form?

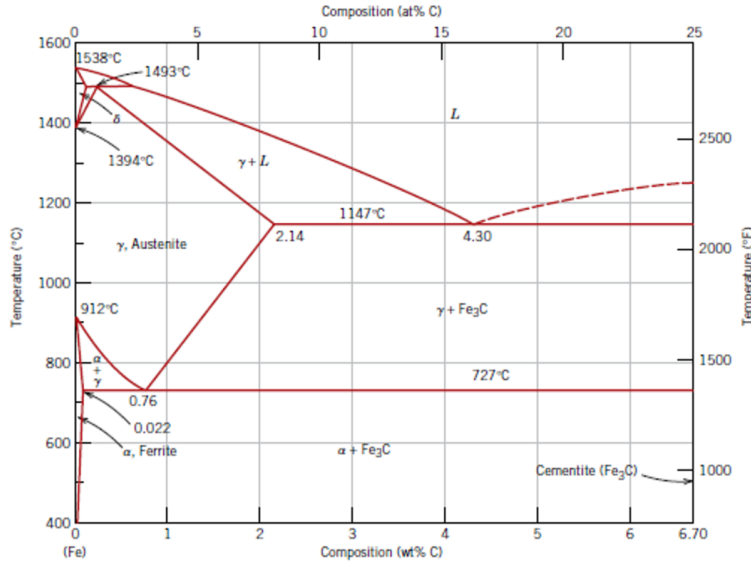 (c) How many kilograms of pearlite and the proeutectoid phase form?

 (d) Schematically sketch and label the resulting microstructure.
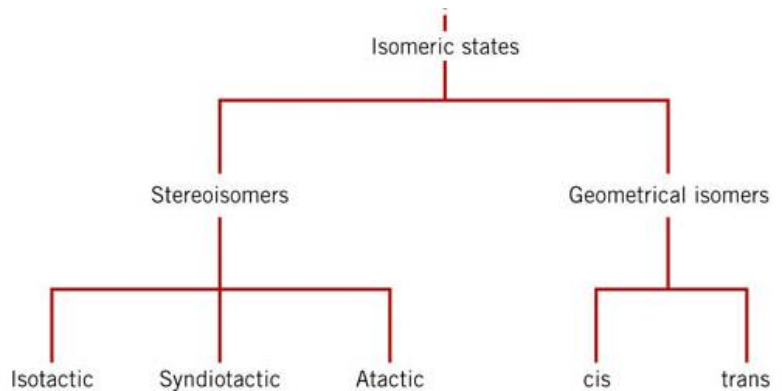
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8. (10 %) The scheme introduces the isomeric states of polymers. Sketch the molecular structures for two geometrical isomers (cis, trans). Briefly describe their features.

9. (10%) Compare the mechanisms of "activation polarization" and "concentration polarization" by words and diagrams.

10. (10%) Explain the theory to measure carrier concentration and carrier type by Hall measurement by figures and words.

11. (10%) Energy gap is a very important characteristic for a semiconductor. Try to propose two methods to determine energy gap based on the measurement of electrical and optical property, respectively. Explain the mechanisms involved.