
UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session of 2003/2004

September/October 2003

EBB 511/3 - Materials Characterisation Techniques

Time : 3 hours

Please ensure that this paper consists of FIVE printed pages before you proceed with the examination.

This paper contains SEVEN questions.

Answer any FIVE questions. If a candidate answer more than five questions, only the first five answered will be examined and awarded marks.

Answer to any question must start on a new page.

All questions answered in English.

...2/-

1. [a] Why atomic (AA) absorption techniques cannot be used to do qualitative analysis.
(30 marks)
- [b] What are the factors that cause chemical interference in the AA technique?
(30 marks)
- [c] A number of standard solutions were prepared and analysed using the atomic absorption technique. The results are given below. Two sample A and B were analysed, the volume are 200 ml and 500 ml respectively. Calculate the percentage of Copper (wt/vol) in each solution.

Concentration of Standard (ppm)	Absorbance
0.5	0.045
1.0	0.090
1.5	0.135
2.0	0.180
2.5	0.225
3.0	0.270
Sample A	0.250
Sample B	

(40 marks)

...3/-

2. [a] Describe briefly the various types of X-ray interactions with matters. Indicate which one that leads to diffraction of X-rays. (35 marks)
- [b] Explain briefly what do you understand by the term structure factor. Determine the selection rules for NaCl having fcc structure. (35 marks)
- [c] Give the types of detector used in X-ray diffractometer. Describe clearly one of them. (30 marks)
3. [a] Briefly describe the basic principles of STM and AFM operation. (40 marks)
- [b] Describe the strength and limitation of STM. (30 marks)
- [c] Give the related SFM techniques and describe one of them. (30 marks)
4. [a] Describe the principle of scanning electron microscope (SEM) with the help of a diagram. What happens when an electron beam was focused on a sample? (50 marks)
- [b] Draw a schematic diagram of a diffractometer. Briefly explain all the components. Also explain how a monochromatic radiation focus on the detector can be obtained. (50 marks)

5. [a] Give the definition of thermal analysis according to ICTAC.
(10 marks)
- [b] Why temperature and environment (atmosphere) control is very important in thermal analysis? Describe the importance of thermal analysis in research and development (R & D).
(40 marks)
- [c] A plastic sample contains 3% of moisture, 15% of glass fibre and 15% of carbon fibre by weight. The sample was heated from room temperature to 650°C in oxygen free nitrogen gas (OFN). Plot the TGA curve and describe.
Please give your comment if at the end of the test only glass fibre remains.
(50 marks)
6. [a] Describe the differences between power compensated DSC and heat flux DSC?
(20 marks)
- [b] Describe the importance of thermal analysis especially in characterization of polymeric materials.
(30 marks)
- [c] With the help of a diagram, describe how viscoelastic property of a material can be determined using dynamic mechanical thermal analysis (DMTA).
(50 marks)

7. [a] Write short note on the topic listed below:

- (i) Environmental scanning electron microscope (E-SEM)
- (ii) Scanning electron microscope-energy dispersive analysis (SEM-EDA)
- (iii) Thermal mechanical analysis (TMA)
- (iv) Differential thermal analysis (DTA)
- (v) Thermogravimetry analysis (TGA)

(50 marks)

[b] Describe the formation and importance of secondary and back scattered electrons in SEM imaging.

(50 marks)