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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : MATERIALS TESTING
COURSE CODE : BDB 40203
PROGRAMME : BDD
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER FIVE (5) QUESTIONS
ONLY

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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- Q1** (a) Explain why tensile testing normally use for metal materials. (4 marks)
- (b) Sketch the typical engineering stress-strain for brittle (ceramic), ductile (metal) and plastic (polymer). (4 marks)
- (c) Fatigue failures occur under dynamic or fluctuating stresses. Differentiate TWO (2) of the possible stress versus time curves that can occur in fatigue test. (5 marks)
- (d) Select THREE (3) indenters and their method that commoly used in the laboratory. (7 marks)
- Q2** (a) Identify FOUR (4) Non Destructive Testing (NDT) for surface inspection. (4 marks)
- (b) Sketch the steps of liquid penetrant inspection. (4 marks)
- (c) Deferentiate the principle between magnetic particle and Eddy Current testing. (5 marks)
- (d) Select THREE (3) function of ultrasonic in NDT and their operation procedure. (7 marks)
- Q3** (a) List TWO (2) method of etching. (2 marks)
- (b) Identify TWO (2) purposes of sectioning. (2 marks)
- (c) Write the steps of hot mounting process for metal specimens. (5 marks)
- (d) Compare the process of sectioning for metal and ceramic. (4 marks)
- (e) Select the information that can be obtained from light optical microscope for metallurgy microstructure inspection. (7 marks)

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- Q4** (a) Explain the information after Transmission Electron Microscope (TEM) characterisation. (4 marks)
- (b) Sketch the interaction of electron-solid in Scanning Electron Microscope (SEM). (4 marks)
- (c) Distinguish between secondary electron and backscattered electron properties before and after interaction with solid sample. (5 marks)
- (d) Evaluate two SEM images (sample of $\text{Al}_2\text{O}_3/\text{Ni}$ composite) as shown in **Figure Q4(d)** in term of type of electron used and image produced. (7 marks)
- Q5** (a) Explain the functions of X-Ray Diffraction (XRD) in the characterisation of crystalline materials. (4 marks)
- (b) Interpret the XRD result as shown in **Figure Q5(b)**. (4 marks)
- (c) Compare the applications of X-Ray Fluorescence (XRF) and XRD in term of similarity and differences. (6 marks)
- (d) Evaluate the type of molecular vibration and clarify FTIR in **Figure Q5(d)**. (6 marks)
- Q6** (a) Explain the functions of thermogravimetric analysis (TGA) in materials testing. (3 marks)
- (b) Write TWO (2) the uses of dynamic mechanical analysis (DMA). (4 marks)
- (c) Examine SEVEN (7) of typical weight loss profile of TGA as shown in **Figure Q6(c)**. (7 marks)
- (d) Evaluate the normal plot for thermal analysis of Differential Scanning Calorimeter (DSC) in polymer sample as shown in **Figure Q6(d)**. (6 marks)

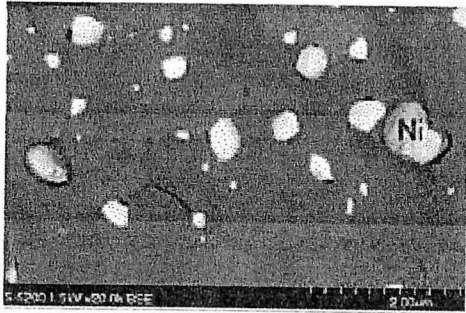
- END OF QUESTION -

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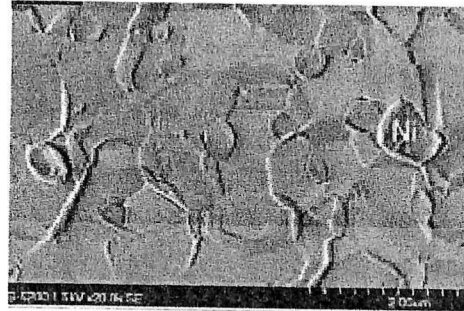
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(i)



(ii)

Figure Q4(d)

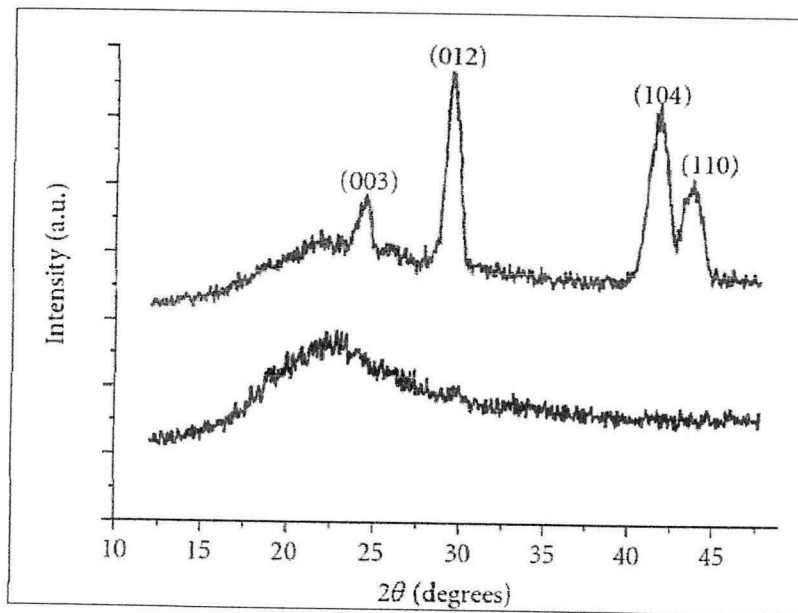


Figure Q5(b)

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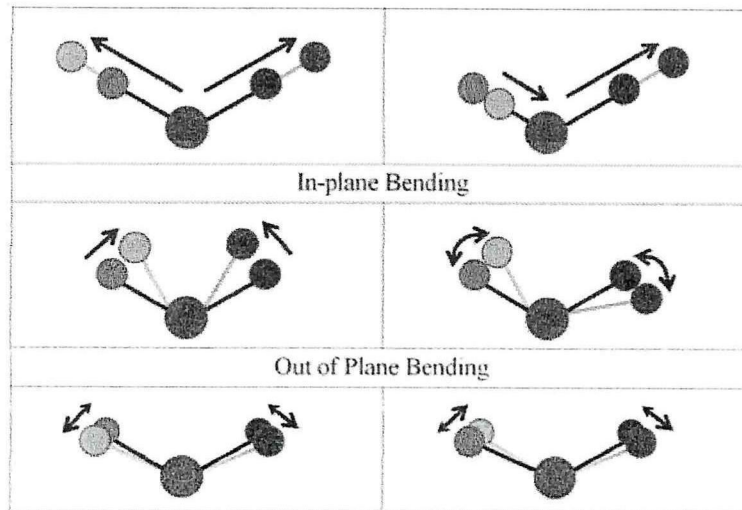


Figure Q5(d)

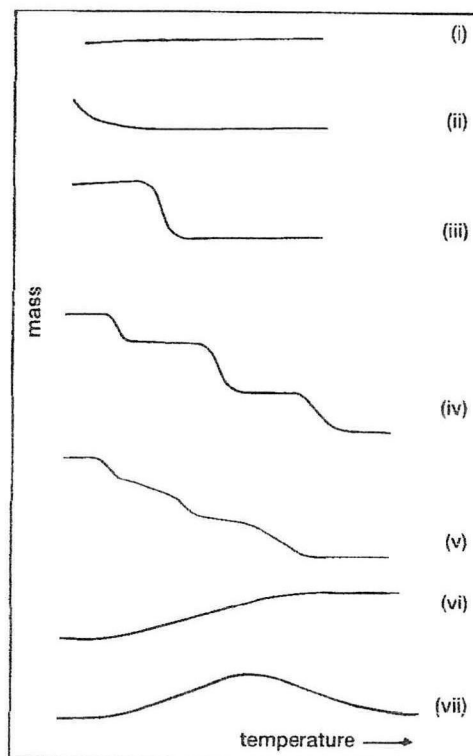


Figure Q6(c)

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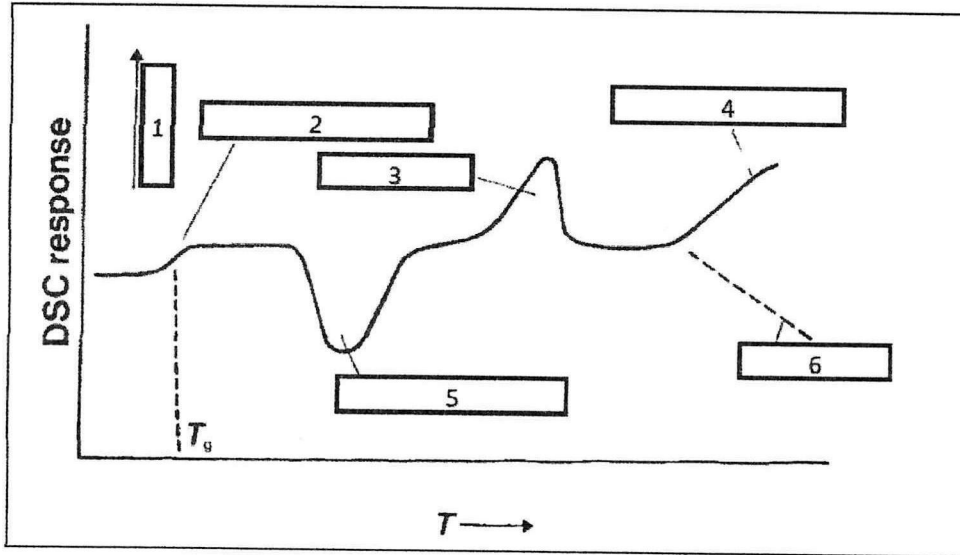


Figure Q6(d)