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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021**

COURSE NAME : ENGINEERING POLYMER AND CERAMICS

COURSE CODE : BDB 40603

PROGRAMME CODE : BDD

EXAMINATION DATE : JANUARY / FEBRUARY 2021

DURATION : 3 HOURS

INSTRUCTION : ANSWERS ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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- Q1** (a) We wish to prepare a mixture of XO_2YOZO with the given composition shows in **Figure Q1 (a)**. Calculate the mol of YO and ZO if 1 mol of XO_2 is used for the mixture? Atomic weight of the elements equals 137.34 for Y, 87.62 for Z, 16.0 for O and 47.9 for X. (6 marks)
- (b) Mr Shah is having a difficulty in dispersing powder particles in the slurry/slip preparation process. He has decided to use surfactants materials to improve the dispersion of the particles in the slurry. In your opinion, did Mr Shah make a correct decision to solve his problem? (4 marks)
- (c) Turbine rotor is one of the ceramic products. Gel casting has been applied as a forming technique to fabricate of the turbine rotor. Based on your knowledge in ceramic processing, arrange and explain the steps involve in the processing route of the turbine rotor. (10 marks)
- Q2** (a) What will happen if an insulator with a complex shape and size went through a conventional drying technique? Select other drying technique which is more suitable for the insulator. (5 marks)
- (b) Guide rollers as shown in **Figure Q2 (b)** are used in the manufacturing process of metal wire. Since the wire travels at high speeds, high levels of tension act on the guide rollers and wear down their surfaces. As a result, there was a need to replace components frequently. Evaluate on how the application of advanced ceramics materials can overcome the problem of roller surface wear. Recommend the suitable advanced ceramic materials for the roller. (10 marks)
- (c) Mr. Faisal has decided to mill tungsten carbide (WC) powder using sintered corundum (Al_2O_3) as grinding bowl and balls. Predict the outcome of the grinding powder and give your opinion. (5 marks)
- Q3** (a) Mr. Amir still could not obtain the required density for his compacted silicon carbide (SiC) block even though it has been sintered at $1500^\circ C$ for 24 hours. The melting temperature for SiC is $2700^\circ C$. From your point of view, what is the cause of this problem? Suggest the actions that can be taken to overcome this problem? (5 marks)
- (b) The mixture of clay and few additives has gone through forming and drying process to produce green body ceramic product. Decide the next stage of ceramic processing need to be carried out for this green body/product. Recommend the profile or graph that related to this stage of process. (10 marks)

- (c) Surface coating is one of the finishing processes for ceramic products. Select TWO (2) other techniques that can be applied for finishing process of ceramic products. (5 marks)

Q4 (a) Modification of polymer properties can be achieved with the addition of additives or filler. Differentiate the function of plasticizer and heat stabilizer in the polymer forming process. (5 marks)

- (b) Recommend the suitable polymer materials for the fabrication of tanks or food processing equipment that expose to aggressive chemicals. (5 marks)

- (c) You are asked to fabricate polyvinyl chloride (PVC) tube for mass production. Select the appropriate polymer processing method for the fabrication and explain in details. (10 marks)

Q5 (a) Your polymer product has faced a catastrophic failure in its application. Suggest several steps that should be taken in improving the resistance of the polymer structure towards catastrophic failure. (10 marks)

- (b) Advanced polymers have been widely used in many engineering fields for example in the below listed application. Correlate the advanced polymers properties or characteristics with its application. (10 marks)

*** The application list for this question will be set randomly in the author system which will display only ONE application of advanced polymer for each student to answer.*

- (i) Polymer Nanocomposites for Coatings
- (ii) Fire Retardant Epoxy Resin Polymer Products
- (iii) Synthetic Biomedical Polymers for Tissue Engineering and Drug Delivery
- (iv) Polymer–Clay Nanocomposites
- (v) Polymer Composites with Carbon Nanotubes
- (vi) Polymer Nanocomposite Membranes for Gas Transport/Diffusion

-END OF QUESTION-

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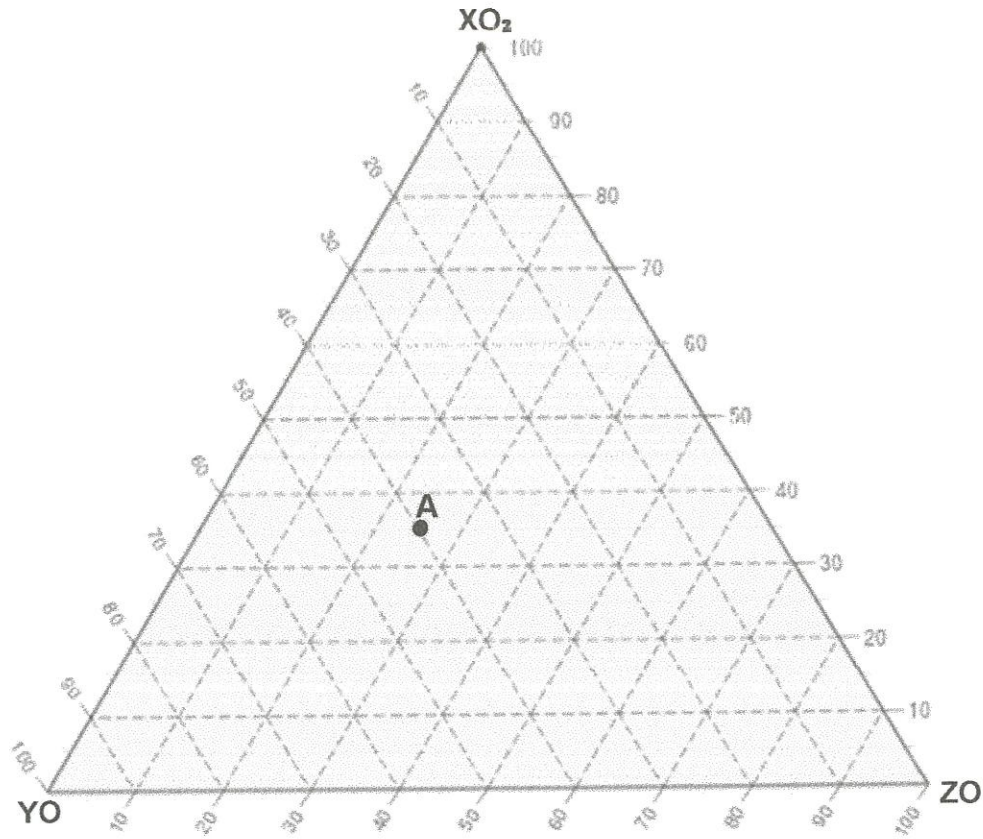


Figure Q1 (a)

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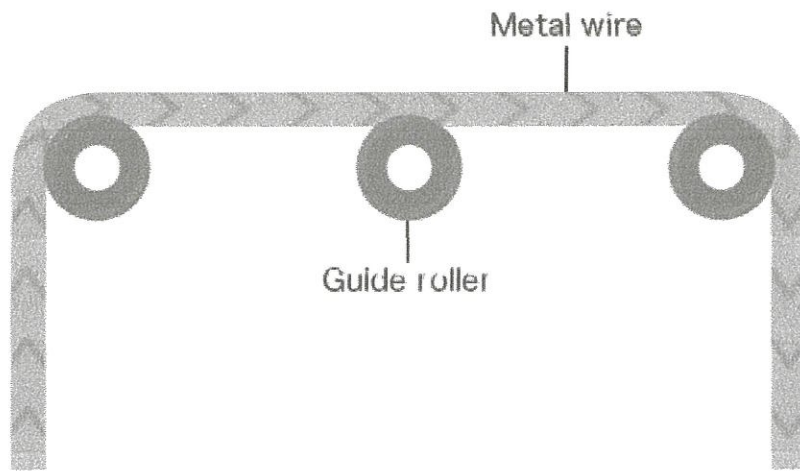


Figure Q2 (b)

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