UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	ENGINEERING POLYMER AND CERAMICS
COURSE CODE	:	BDB 40603
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JULY/AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2.THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**. 3.STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) You have been asked to prepare a mixture of XO_2YOZO with the given composition as shown in **Figure Q1 (a)**. What is the mol of YO and ZO if 1 mol of XO_2 is used for the mixture? The atomic weight of the elements equals 47.9, 137.34, 87.62 and 16.0 for X, Y, Z and O respectively.

(6 marks)

(b) Crack has been observed after drying process of a ceramic product. Examine the factors that need to be controlled in order to avoid defects on ceramic bodies during drying process.

(6 marks)

(c) Mr. Amir having difficulty in forming the ceramic mixture during extrusion process. He has decided to use deflocculant as a processing aid to improve the flexibility of the ceramic plastic body. In your opinion, did Mr Amir make the correct decision to solve his problem?

(4 marks)

(d) Contamination can occur in the milling process. Recommend TWO (2) methods that can be used to control or overcome contamination during milling.

(4 marks)

Q2 (a) Differentiate the purpose of milling and mixing process in the ceramic product processing route.

(4 marks)

(b) In the production process for steel wire **Figure Q2 (b)**, galvanization is applied to prevent rust. During that process, the guide used to dip a steel wire into the galvanization bath (500°C) wears out so severely that the guide requires frequent replacement. Galvanization process guides traditionally use molten silica, which is a refractory material for casting. However, due to contact with steel wires, the guides wear out quickly, requiring frequent replacement. In addition, since the guides are large, replacement work is difficult. Evaluate how the application of advanced or fine ceramics materials can overcome the problem of guide wear and degradation. Recommend suitable advanced ceramic materials for the guide.

(10 marks)

(c) Mr. Ibrahim required a high density of a compacted silicon carbide (SiC) block for his application. Therefore, he sintered the SiC at 1300 °C for 24 hours. The melting temperature for SiC is 2700 °C. Predict the outcome of the SiC density and give your opinion.

(6 marks)

Q3 (a) Advanced ceramic products normally need post-sintering processing. The surface property of wind turbine rotor blades needs to be altered to increase its abrasion and corrosion resistance. Recommend a suitable finishing technique that can be applied to modify the surface property of the turbine rotor blades as required.

(4 marks)

(b) Ceramic raw materials can be obtained from various techniques besides natural sources. Propose a technique to form or growth a ceramic film on a substrate. Explain in detail the process.

(10 marks)

(c) Recommend the suitable polymer materials for the fabrication of bullet proof vests that require high resistance.

(6 marks)

Q4 (a) You want to design an insulation boards that are approximately 4 ft wide and 8 ft tall. The selected material for the boards must provide good thermal insulation. What material would you choose?

(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 your product fabrication and explain it in detail.

(10 marks)

Q5 (a) Your polymer product has faced a catastrophic failure in its application. Evaluate the factors that can affect the mode of failure in polymer materials.

(10 marks)

(b) Advanced polymers have been widely used in many engineering fields such as membranes for gas transport or diffusion. Correlate the membrane polymer properties or characteristics with its application in gas transport.

(10 marks)

-END OF QUESTION-

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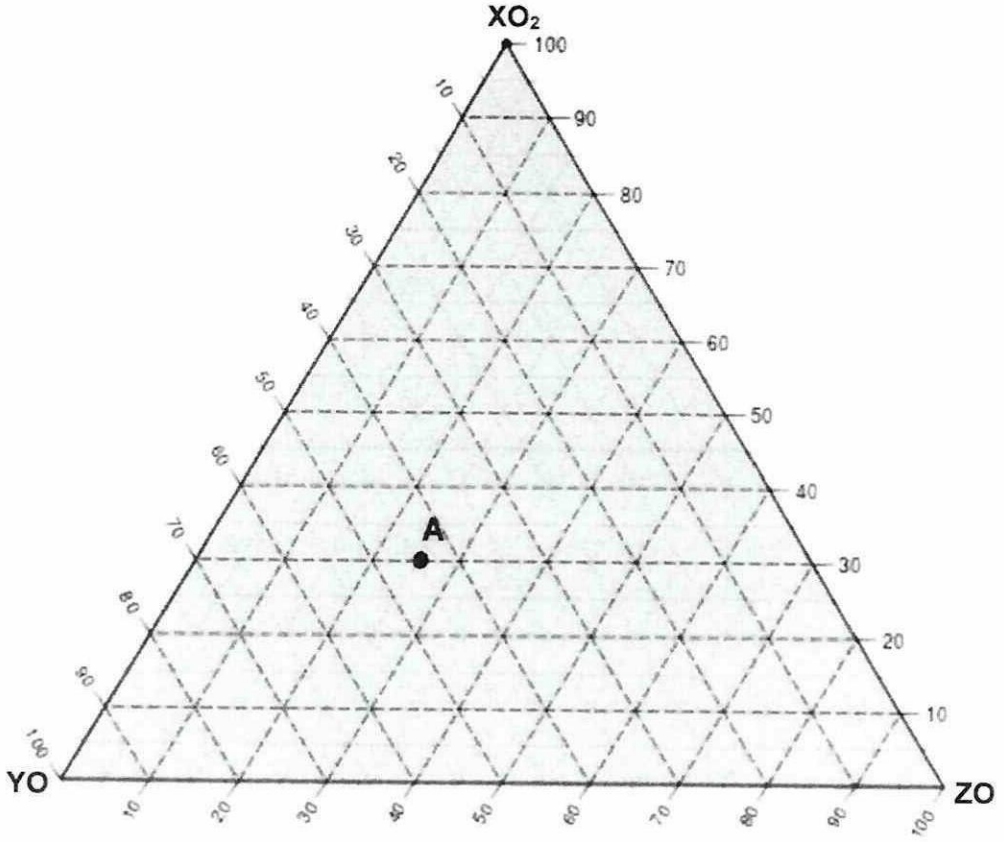

Figure Q1 (a)

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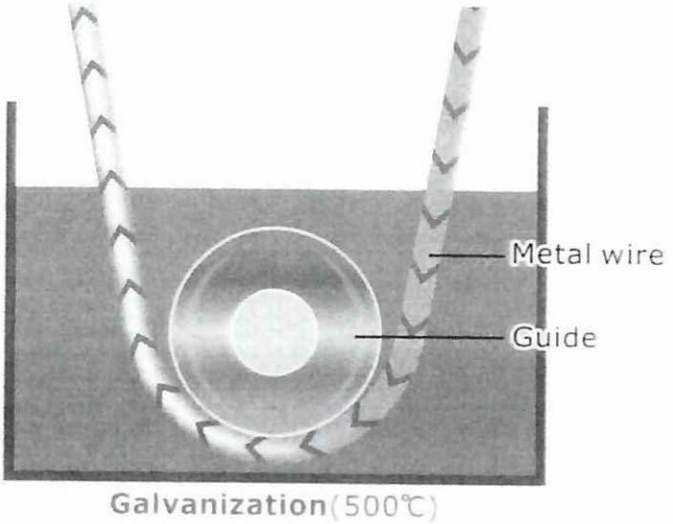

Figure Q2 (b)