Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 2
SESSION 2021/2022

COURSE NAME	:	ENGINEERING POLYMER & CERAMIC
COURSE CODE	:	BDB 40603
PROGRAMME	:	BDD
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **FIVE (5)** QUESTIONS ONLY
		2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**
		3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIALS OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSEDBOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (6)** PAGES

Q1 (a) With an appropriate diagram, discuss the difference between polymer and ceramic atomic arrangement and structure in general that have made both materials have been used for difference purposes.

(6 marks)

(b) Suggest **TWO (2)** applications of ceramic component that always known as refractory and inert materials.

(4 marks)

(c) Even though ceramic materials is knowns with its brittleness but there are still some demand from industry especially for high performance and critical purpose application. Suggest at least **FOUR(4)** properties that owned by this materials.

(5 marks)

(d) Differentiate between oxide and non-oxide ceramic and suggest **ONE(1)** application for each materials.

(5 marks)

Q2 (a) Drying is one of the important task in most ceramic production. Based on this statement construct the drying plot for each component that had gone through earlier wet milling and dry milling process, and give detail explanation any different between these two plots.

(5 marks)

(b) Give the strong reason why most solid state sintering need an additive to ensure sintering will take place as compared to liquid sintering. Support your answer with an appropriate diagram.

(5 marks)

(c) There several important plastic forming process that widely used in industry to fabricate ceramic product. Suggest **ONE(1)** forming technique that able to produce a mass production of simple and consistent shape like tube or rectangular bar and elaborate in detail this technique.

(5 marks)

(d) Interpret two possible milling condition that will occur inside the rotating mill. Illustrate with a proper diagram the best milling condition of ceramic particle inside the milling bowls.

(5 marks)

Q3 (a) Sanitary ware in **Figure Q3(a)** can be produced using ceramic forming techniques. Select a suitable forming process and explain it briefly.

(6 marks)

(b) Drying is very important in most ceramic fabrication process. Illustrate in detail the stages of drying for ceramic porous component.

(4 marks)

(c) Justify the important of sintering stage that need to be conducted for most of the green ceramic parts.

(5 marks)

(d) State the different between dry and wet mixing process. Propose a suitable mixing for pottery, bricks and cement.

(5 marks)

Q4 (a) In polymer synthesis, there are **TWO(2)** types of polymerization technique which are addition polymerization and condensation polymerization. Propose an appropriate polymerization technique to produce thermoplastic product and explain briefly.

(4 marks)

(b) Differentiate Liquid Crystal Polymer(LCP) as compared to normal polymer structure of thermoset and thermoplastic in term of their molecular arrangement and structure.

(4 marks)

(c) With considering some advantages of thermoset and thermoplastic polymer, suggest **ONE(1)** suitable application of these polymers with a brief explanation .

(4 marks)

(d) Based on the molecular structure difference between LDPE, HDPE and UHMWPE, answer the following questions.

i) Justify the different properties behaviors for both polymers in **Table 4(d),** even though they are from similar group of polymer types.

(4 marks)

ii) Predict the properties of UHMWPE based on **Table 4(d)** criteria when comparing this polymer with other two polymers in **Table 4(d).**

(4 marks)

Q5 (a) Suggest several advantages of polymer over ceramic in terms of design and processing that makes these materials are more preferable in most engineering component.

(5 marks)

(b) Differentiate thermoplastic elastomer(TPe) with common types polymer i.e thermoset and thermoplastic and suggest **TWO(2)** advantages of this materials that have made this materials have been used widely in industry.

(5 marks)

(c) Suggest several advantages of polymer that will present glassy and melting temperature with an appropriate examples of polymer name.

(5 marks)

(d) Suggest **ONE(1)** properties of polymer that represent the lines of synergetic and anti-synergetic effect and in **Figure Q5(d)** with an appropriate example of polymer types.

(5 marks)

Q6 (a) Most normal polymer materials is an amorphous structure and has high plasticity property with rougher fracture surface area. Propose a polymer types that might undergone brittle failure and has smooth fracture surface as contradicted with normal polymer behavior and explain briefly on this specific behavior.

(4 marks)

(b) Propose a suitable plastic processing technique that able to produce various shape of composite structure (additive & matric) with simple processing steps.

(6 marks)

(c) Suggest **THREE(3)** mode of polymer failures that caused by several factor and explain in detail **ONE(1)** of these mode of polymer failure

(5 marks)

(d) Compounding of polymer with additives able to change and improve their physical, mechanical and processing properties in producing polymer alloy or blend. Suggest **THREE (3)** filler that can increase physical and thermal properties of polymer alloy or blend.

(5 marks)

-END OF QUESTIONS –

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Figure Q3 (a) : Sanitary ware

Table 4(d) : HDPE versus LDPE properties

HDPE	VERSUS	LDPE
HDPE has a higher density than LDPE		LDPE has a lower density than HDPE
Stronger than LDPE		Weaker than HDPE
Can withstand relatively higher temperatures than LDPE		Not as resistant to higher temperatures as HDPE

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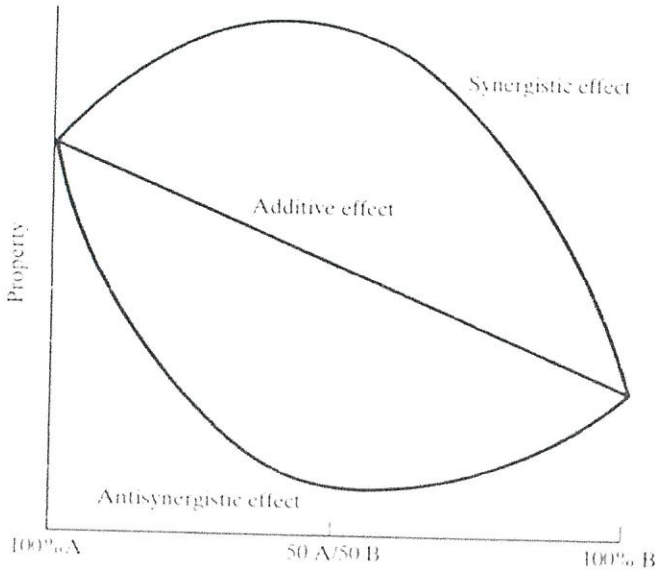

Figure Q5 (d) : Schematic showing additive, Synergistic and Antisynergistic effect during compounding