Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	ENGINEERING POLYMER AND CERAMIC
COURSE CODE	:	BDB40603
PROGRAMME	:	4BDD
EXAMINATION DATE	:	JUNE/JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE(5)** QUESTIONS ONLY.

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Many industries classify polymer in different ways. In your opinion what are the differences between plastic and polymer?

(6 marks)

(b) Polyethylene (PE) structural units resulting from the reaction of ethylene monomers may in principle be linked together in any conceivable pattern. Based on your knowledge, summarize the differences between high density polyethylene (HDPE), low density polyethylene (LDPE) and cross-linked polyethylene (XLPE).

(4 marks)

(c) The chemical reactions of monomers joined together to form polymer are called polymerization reaction. Explain in detail the polymerization process of polystyrene (PS).

(10 marks)

Q2 (a) Extrusion is the most common polymer processing (60% of world production). Explain in detail the effect of polymer molecular weight on die swell and melt fracture during extrusion process.

(6 marks)

(b) The injection molding process requires the use of an injection molding machine, raw plastic material, and a mold. Based on your knowledge explain the key important factor in injection molding technique.

(4 marks)

(c) Polyvinyl chloride (PVC) is the world's third-most widely produced synthetic plastic polymer, after polyethylene and polypropylene. Based on your knowledge in polymer engineering, what is your consideration for PVC to be applied in application as stated below.

(i) Electrical and electronic
(ii) Automotive
(iii) Structural

(10marks)

Q3 (a) In your opinion, what type of plastic processing that suited for the manufacture of the bottle and other simple hollow-shaped parts. Explain in detail the principal problem in forming a bottle based on your suggestion processing method.

(5 marks)

(b) Compare the advantages of casting and plastic molding operations in term of equipment size and cost.

(5 marks)

(c) As procurement engineer, you verified the polymer molecular weight and degree of crystallinity which send by your supplier. However, you found that the average molecular weight of that polymer is 40% higher and degree of crystallinity 20% higher as compared to the data given by supplier. In your opinion what the effect of these variations to tensile strength and processing temperature of the polymer? As an engineer do you accept that polymer or return back to supplier? Give your reason.

(10 marks)

Q4 (a) In a ball mill of diameter 2000 mm, 100 mm diameter steel balls are being used for grinding. Presently, for the material being ground, the mill is run at 15 rpm. At what speed will the mill have to be run if the 100 mm balls are replaced by 50 mm balls, all the other conditions remaining the same? Use gravity = 9.812 m/s^2.

(4 marks)

(b) Contamination is a problem in milling process. Suggest THREE (3) methods that can be used to control or overcome contamination during milling.

(6 marks)

(c) Ceramic milling is a process for reducing the particle size of solids to some required degree of subdivision. In your opinion what will happen if the rotating speed of mills is too fast or too slow.

(10 marks)

Q5 (a) Ceramic component has higher elastic modulus and hardness value compared to the metal component. Discuss this statement based on materials structure and bonding.

(4 marks)

(b) Mr. Faisal 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)

(c) In drying process, water is removed from an unfired ceramic object or raw material in the green or as-formed state or in the as-received state. Describe the sequence in which various water are removed from the ceramic body.

(6 marks)

(d) What might happen if an insulator with a complex shape and size went through a conventional drying technique? Propose other drying technique which is more suitable for the insulator.

(5 marks)

Q6 (a) Mixing is a process of combining the constituents of a ceramic body to produce more chemically and physically homogeneous system for forming. Mixing can be conducted either in dry or wet condition. In your opinion explain TWO(2) biggest challenges to use dry mixing process.

(4 marks)

(b) Sintering is the process of compacting and forming a ceramic green body by heat or pressure without melting it to the point of liquefaction. Based on your understanding, explain the idealized model for solid state sintering behavior.

(6 marks)

(c) Discuss the important of ceramic properties that make them suitable to be used in the stated applications:

(i) Automotive
(ii) Fuel Cells

(10 marks)

-END OF QUESTION-