Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	ENGINEERING POLYMER AND CERAMIC
COURSE CODE	:	BDB 40603
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS IN PART A 2. ANSWER ONE (1) QUESTION **ONLY** IN PART B

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

PART A

Q1 (a) List the factors that differentiate ceramic processing from metal processing.

(5 marks)

(b) Explain in detail, why engineered ceramics are increasingly being used in commercial and military aircraft, and have been used in the space shuttle and its equipment compared to metal materials?

(7 marks)

(c) What are the recent applications of ceramics in the electronics industry? Why are ceramics selected?

(8 marks)

Q2 (a) Describe the dry-pressing method for producing such ceramic products as technical ceramic compounds and structural refractories. What are the advantages of dry-pressing method?

(5 marks)

(b) Mullite shows up on a phase equilibrium diagram as $3Al_2O_3$. $2SiO_2$. (JAR for Al = 27.0 g/mol, Si = 28.1 g/mol, O = 16.0 g/mol).

(i) What is the mol % of Al_2O_3 and SiO_2?

(ii) What is the wt % of Al_2O_3 and SiO_2 in mullite?

(7 marks)

(c) Alumina (Al_2O_3) is a major material of fine ceramics which has an excellent mechanical strength, excellent wear and chemical resistance as well as excellent electrical insulation. Alumina has been used on mobile phone, wireless charging devices and cameras to provide high visual decoration to products. Based on your knowledge, please select and describe one method to manufacture these products.

(8 marks)

Q3 (a) If you want to produce 10 grams of nylon, how much will your starting ingredients quantity should be?

(5 marks)

(b) Explain crosslinking and how it affects a material's mechanical and rheological (flow when melted) properties.

(7 marks)

(c) Plastic slides are commonly seen at the children playgrounds. How do think the slides were manufactured? Limit your answers to polymer processing techniques only.

(8 marks)

Q4 (a) 1 gram of polyvinyl chloride (PVC) was used in a thermogravimetry (TG) experiment. If 1000 chlorine (Cl) atoms were decomposed at the end of the experiment, what is the PVC's degree of polymerization?

(5 marks)

(b) How can you distinguish a profile extrusion part from an injection moulded part?

(7 marks)

(c) Since 1980s, polymers could also be used as alternatives in producing ceramics. Taking silicon carbide (SiC) as example, construct series of theoretical chemical reaction to produce the ceramic.

(8 marks)

PART B

Q5 Titanium has desirable properties such as high mechanical strength and excellent corrosion resistance that make suitable biomaterials for many bone implant at high load bearing area applications. However, titanium is bioinert which do not initiate a response or interact when introduced to biological tissue

(a) Please select ONE (1) ceramic material that can solve for this problem and justify your selection.

(10 marks)

(b) Develop ONE (1) manufacturing process to accommodate your solution.

(10 marks)

Q6 (a) "Star Wars" is an epic film series of space adventures. In spite of tremendous storyline, there are also "polymers" as the unsung co-stars. Using THREE (3) examples of the main characters in any six Star Wars installments (Episode I – VI), summarize the application of polymers in boosting special effects in the movies.

(10 marks)

(b) What are the evidence and criteria that could justify that polyphenylene sulfide (PPS), polyether ether ketone (PEEK) and Nylon 6/6 are high temperature polymers?

(10 marks)

-END OF QUESTIONS –