UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2011/2012

January 2012

EBB 523/3 – Ceramic Processing

Duration : 3 hours

Please ensure that this examination paper contains FOUR printed pages before you begin the examination.

This paper consists of SIX questions.

Instruction: Answer **FIVE** questions. If candidate answers more than five questions only the first five questions answered in the answer script would be examined.

The answers to all questions must start on a new page.

All questions must be answered in English.

1. [a] Briefly describe the general properties of ceramic raw materials for conventional and advanced ceramic.

(10 marks)

[b] With the help of flowchat, explain and differentiate the processing steps to produce ceramic, glass and glass ceramic.

(45 marks)

[c] Discuss the requirements for milling media and the expected particle size distribution if the shape of the milling media is:

(i) Sphere

(ii) Rod

(iii) Irregular

(45 marks)

2. [a] Describe the three categories of chemical process for ceramic powder production. Explain any of the method for each category.

(60 marks)

[b] Mixing is one of the important step in ceramic processing. Explain in details and suggest an additive to be used to optimize the processing condition.

(40 marks)

3. [a] Ceramic materials are now being used extensively in electronic industries.

(i) List at least four different electronic implements that are made of, or contain ceramics.

(ii) For one of these implements, write an essay in which you do the following: (1) Cite the materials that are used as a main component, binder and if possible the proportion of each component; (2) Note the function of each component (3) Describe the process by which the implements is fabricated.

(70 marks)

[b] Some ceramic materials are fabricated by hot isostatic pressing. Describe and cite some of the limitations and difficulties with this technique.

(30 marks)

4. [a] From a molecular perspective, briefly explain the mechanism by which clay minerals become hydroplastic?

(20 marks)

[b] Explain why a clay, once having been fired at an elevated temperature loses its hydroplasticity?

(20 marks)

[c] Cite one reason why drying shrinkage is greater for slip casting products that have smaller clay particles.

(15 marks)

[d] Explain briefly with aid of a diagram the following casting process:

(i) Gel casting

(15 marks)

(ii) Tape casting

(15 marks)

(iii) Slip casting

(15 marks)

5. [a] How the polymeric replication technique can be very useful for the production of porous ceramic foam?

(50 marks)

[b] How the ceramic can be strongly joined to metal? What are the difficulties you may encounter?

(50 marks)

6. [a] Why do you need to use phase diagram for the best selection of “liquid” component in the liquid-phase sintering technique? Elaborate your answer with a specific example.

(50 marks)

[b] How do you avoid abnormal grain growth in any ceramic product which was sintered through solid-state sintering?

(50 marks)

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