Uva Wellassa University, Sri Lanka
End Semester Examination - March 2012

SCT 441-1 Ceramic Technology

Time: Two (02) hours

Total 05 questions
Answer **04** questions only

01) i. For an ionic ceramic compound, what are the two main characteristics of the ions that determine the crystal structure?

ii. Among MgO and SiC ceramics, which should show the *highest degree of the ionic character*? Briefly explain your answer.

iii. List three major outcomes related to the *strong bondings* in ceramics.

iv. The ionic radii of Na^+ and Cl^- are 0.102 and 0.181 nm, respectively. What would be the coordination number for each Cl^- ion in the FCC (face centered cubic) rock salt crystal structure of NaCl?

v. Based on the above information, compute the theoretical density of NaCl. Atomic weights of Na and Cl are 22.99 g/mol and 35.45 g/mol, respectively. Avogadro's number is 6.023×10^{23} mol^{-1}.

(25 marks)

02) i. "*Measured fracture strength* values for ordinary ceramics are significantly smaller than the *theoreticaly predicted fracture strength* values". What causes this discrepancy?

ii. Briefly explain why ceramics show a considerable variation in fracture toughness.

iii. With the help of a rough sketch of the transverse bending setup, very briefly explain how to determine the 3-point bending flexural strength of a metal rod having a circular cross section.

iv. If this metal rod fractured at 658 N, compute its flexural strength. The radius of this metal rod is 9.85 mm and the support point separation distance is 25.0 mm.

v. Give two main reasons for porosity to be detrimental to the flexural strength of a material.

(25 Marks)

03) i. State two useful characteristics of clay minerals for forming ceramics bodies

ii. What are the *main functions* of clay, quartz and feldspar in forming whiteware ceramics?

iii. With the help of schematic representation, very briefly explain the formation of ceramics by *extrusion*, which is the most common hydroplastic forming technique for ceramics.

iv. Very briefly discuss about the mold materials used in casting whiteware ceramics.

v. Cite the main advantages and limitations associated with cold-isostatic pressing.

(25 Marks)

04) i. List the five *key steps* in manufacturing ceramics.

ii. Give a very brief account on effects of fluxes on ceramic body formation. What is the main fluxing agent used in Sri Lankan ceramic manufacturing industry?

iii. Name three types of major defects, which are introduced due to improper *drying and firing* of ceramic bodies.

iv. Make a rough sketch of a heating program suitable for the heat treatment of whiteware ceramics.

v. Briefly explain why it is so critical to control cooling process in ceramic manufacturing.

(25 Marks)

05) i. Briefly explain the term *sintering* used in ceramic manufacturing. What is the main driving force for sintering?

ii. With the help of a schematic representation, make a brief account on the six mechanisms and their paths responsible for transporting matter in sintering. Which of these mechanisms are really effective for densification?

iii. Express the relationship between the *driving force* for sintering and the *surface energy*.

iv. What are the two major ways for speeding up of sintering?

v. List three major actions which may enhance the reaction rates in solid state sintering.

(25 Marks)