# Organic Nano-Materials Engineering

## Exam #2 May. 03, 2010

1. (a) Discuss similarities and differences in their micelle formation behavior between block

copolymers and low molecular weight surfactants. (15)

(b) Discuss advantages of dendrimers i) as a nanostructured material and ii) as a nanostructure directing material. (10)

2. Suppose that you have two different kinds of diblock copolymers: one consists of coil-coil blocks and the other rod-coil blocks. Discuss the self-assembly behavior when i) TLC→i > Tg and ii) Tg > TLC→i for polymer melt and polymer solution, respectively. Here, TLC→i is the transition temperature of the rod block where liquid crystalline phase becomes isotropic phase, and Tg is the glass transition temperature of the coil block where glassy phase becomes rubbery phase or vice versa. (20)

3. Discuss why the two-step anodizing method provides more regular arrayed pore structure than does a conventional method. (10)

4. Explain the following terms: (10)

(a) Sol

(b) Gel

(c) Xerogel

(d) Aerogel

5. In preparation of various types of nanostructured materials based on silicon alkoxide, there are two common major reactions involved, i.e. hydrolysis and condensation reactions. These reactions are influenced by many experimental parameters. Discuss the effects of each of the following parameters on (i) the reaction rates and (ii) the reaction mechanism of (I) the hydrolysis and (II) the condensation reactions, respectively. (30)

(a) Catalyst (acid and base)

(b) Steric & inductive effect

(c) Kind of solvents used

6. Describe the representative properties of zeolite. And suggest possible applications relative to the each properties. (15)

7. You have watched the TV documentary program about carbon industry. Based on the program, what do you think of the future of scientific and industrial developments of carbon materials (10).