

Department of Mining and Materials Engineering
Faculty of Engineering, Prince of Songkla University

Final Examination: Semester 1

Academic Year: 2004

Date: 3rd October 2004

Time: 9.00am-12.00pm

Subject: 237 – 513 Surface Engineering

Room: A203

Instructions: 1. Only a sheet of A4 note and a dictionary are allowed.

2. Answer all questions in the answering sheets provided.

ทูลจรตใการสอบทอษขัันต่ำ คอื ปรบัตกใการยวชษาที่ทูลจรตและพัทการเรยยน 1 ภาคการศกษา

1. One of the selection criteria of surface coating is the coating structure. How is the coating structure of the vapour state process different from the molten/semi-molten state process?
2. State examples of surface coating techniques that involve each of the following:
 - (i) a gaseous phase (2 examples)
 - (ii) a molten, semi-liquid phase (1 example)

Compare these techniques in terms of the following:

- (i) deposition rate
- (ii) coating thickness
- (iii) limitation on substrate material
- (iv) distortion of substrates

Design the coating materials and explain coating techniques that you would use to protect steel cutting tools in order to give good oxidation, corrosion and wear resistance. Also describe the process principle of the chosen techniques.

3. (a) Describe, showing approximate temperature profiles, the function and benefits of a thermal barrier coating system (TBC) applied to a Ni-based superalloy rotating blade for a gas turbine engine.
 - (b) What are the performance requirements of a TBC system for this application?

- (c) Typically two layers of coating are necessary for the complete TBC system. Why? Suggest the materials currently used for both layers that meet the requirements above and give your reason.
- (d) Describe briefly the methods you would use to fabricate the complete TBC system (both layers) for a stationary component (such as a nozzle guide vane) and give your reason.
- (e) Why might we use different coating methods to fabricate a TBC on a rotating blade?
4. Explain which surface coating techniques you would choose for the following engineering components and briefly describe each technique (with the aid of schematic diagram):
- (a) Glass coating on steel
 - (b) Ni plating on an automotive bumper
 - (c) Aluminised steel strip

Good Luck!!!

ทูลจริตในการสอบโทษขันต่ำ คือ ปรับตกในรายวิชาที่ทูลจริตและพัทการเรียน 1 ภาคการศึทกษา