

Department of Mechanical Engineering
University of Saskatchewan

ME324.3 Engineering Materials

Mid-Term Examination (Closed Book)

69

75

Student #: _____ Student Name _____

Instructor: Prof. A.G. Odeshi

Time Allowed: 2 h

October 17, 2008.

1. Answer ALL questions.
2. Two formula sheets are allowed but must be turned in with your answer script(s).

Question 1 - 25 points

Points

a. What are *smart materials*? Give one application of these materials

3

Smart materials are materials that adapt to their surroundings. They include an actuator & controller. anything that requires adaptability - helicopter. Smart materials are those which are able to sense changes in their environment and then respond in a predetermined manner.

(2 1/2)

b. A new material is being considered for application as a surgical implant and prostheses. List two requirements that this material must meet before it can be accepted as a suitable replacement for damaged human bone or diseased human organ.

3

- Corrosion resistant
- Non-toxic

(3)

c. Distinguish between *iron-making* and *steel-making* processes

3

iron making is refining iron ore down to pig iron and then further refining it to remove impurities. steel making is taking iron and adjusting the amount of carbon present (usually increasing) to form steel and usable shapes. sheets, rods, etc.

(3)

e. Give two functions of *coke* in a blast furnace reduction of iron ore to elemental iron

3

~~Source of carbon~~

helps create the heat in the blast furnace

Source of heat & Acts as a reducing agent.

(2½)

f. Why is *pig iron* considered unsuitable for structural applications? What should be done in order to make it suitable?

3

The carbon content is too high. It is brittle and not malleable. The pig iron needs to be reduced in the Bessemer process to a state that has less carbon and impurities.

along with other impurities.

(3)

g. List two differences between *basic oxygen furnace* and *electric arc furnace*

2

electric arc furnace uses electrodes and electric current to heat the metal up. basic oxygen furnace uses oxygen to react and heat up the metal to remove the impurities. electric arc furnaces are more suited to reducing scrap metal and the reduction of pig iron.

(2)

h. The strength of an aluminum alloy was observed to increase after plastic deformation at room temperature. Give reason for this observed increase in strength

2

The plastic deformation is strain hardening the material. The imperfections in the metal were moved closer together so they interfere with the motion of each other. as material strength is somewhat based on imperfections (defects) moving.

(2)

i. What happens when shear stress high enough to cause motion of dislocation is applied to a metallic material?

2

The material shears perpendicular to the dislocation

(1)

