

AE4ASM004: Manufacturing of Aerospace Structures & Materials

Preparatory Test

Question 1 [Composite basics]

Carbon/epoxy is the most frequent fibre/resin combination used in aircraft composite structures nowadays. Can you explain why? In these structures, which is the most common reinforcing type (continuous or discontinuous) and why? Is epoxy a thermoplastic or a thermoset resin and why?

Question 2 [CTE's, elastic & plastic deformation]

A flat rectangular laminate made out of two different metals intimately connected to each other is subjected to a certain temperature cycle in an oven. Once the cycle is completed, the originally flat laminate turns into a cylindrical shell. What does this indicate regarding the properties of the two materials and their isotropy? Would you expect the same effect in a composite laminate?

Question 3 [Heat capacity/heat transfer]

A certain part is placed in an oven originally at room temperature. Once the oven door is closed, the temperature in the oven is increased by injecting hot air into it. The temperature at a specific location of the part is monitored using a thermocouple. What can you say about the heating rate in the part in relation to its mass? What can you say about the cooling rate if (1) hot water / (2) hot oil are injected in the oven instead of hot air (consider that water, oil and air are at the same temperature)?

Question 4 [relation between material and structure]

Material properties and structural properties sometimes get the same names although they are not identical. What is the similarity and difference between material stiffness and structural stiffness (both for tensile load)? What parameters influence the structural stiffness?

Question 5 [understanding of mechanical behaviour of metals]

During testing metal alloys show elastic and plastic behaviour. Describe both behaviours briefly. Does a metal alloy deform exclusively plastically beyond its yield point? What parameters of a stress strain curve are important for the evaluation of the formability of a metal alloy? How can you change the formability of a metal alloy (increase or decrease)?

Question 6 [manufacturing processes & trade-off]

What processes are available to manufacture a thin-walled 3D product (rough outer dimensions 0.25 x 0.25 x 0.25 meter)? What are the basic principles of each of the processes you mentioned? What criteria would you choose (and why) when you have to select the best process?