AML 883: Properties and Selection of Engineering Materials

Major Exam, May 2007 Max. Marks: 30

Name	
Registration Number	

Note: • Answer only inside the boxes. • Be brief and to the point. • In all parts label the items appropriately • Negative marking scheme will be used • The issues have been idealized and certain aspects are hypothetical

1) [10]

A functionally graded cuboidal specimen (Fig.1) of an Al-Cu (Cu < 5 wt%) alloy is to be made using a differential aging treatment for 1 hour. The E1 end of the specimen is to have a hardness of 60 VPN and the E2 end a hardness of at least 80 VPN. Outline the process steps to be used to achieve the above, along with the reasons for the choice of steps and the overall process.

2) [10]

After aging of an age hardenable alloy at a certain temperature the microstructure in Fig.2 is obtained (shown schematically).

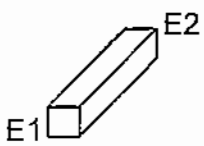


Fig.1

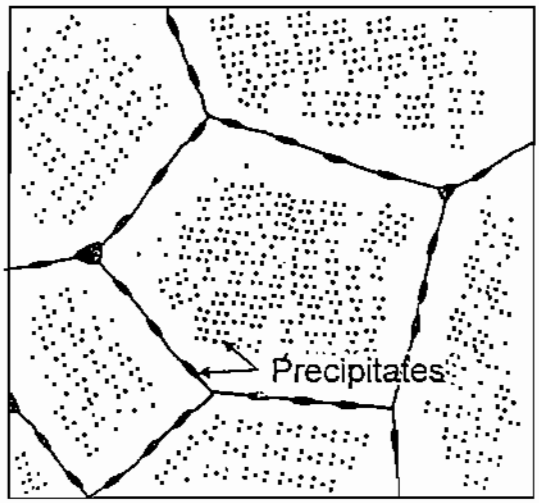


Fig.2

a) Explain the mechanisms operative which can lead to such a microstructure. *(Fig.2 can be used in the answer)*

b) Comment on the properties of the material (strength, corrosion resistance etc.) at this scale as a result of such a microstructure.

Additional Figures which may be used for in the answer of any of the questions:

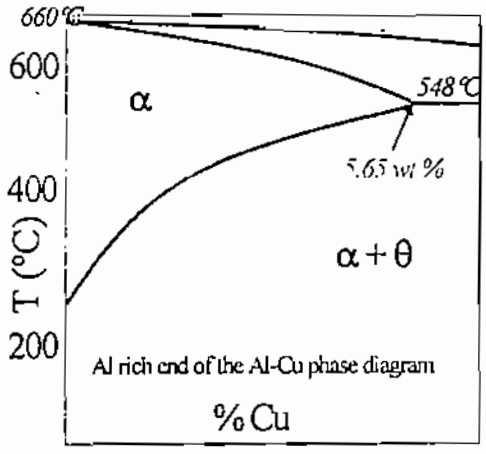


Fig.3

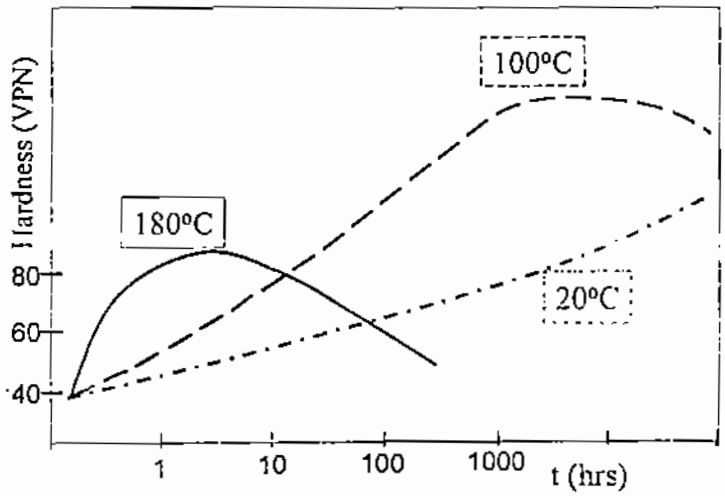
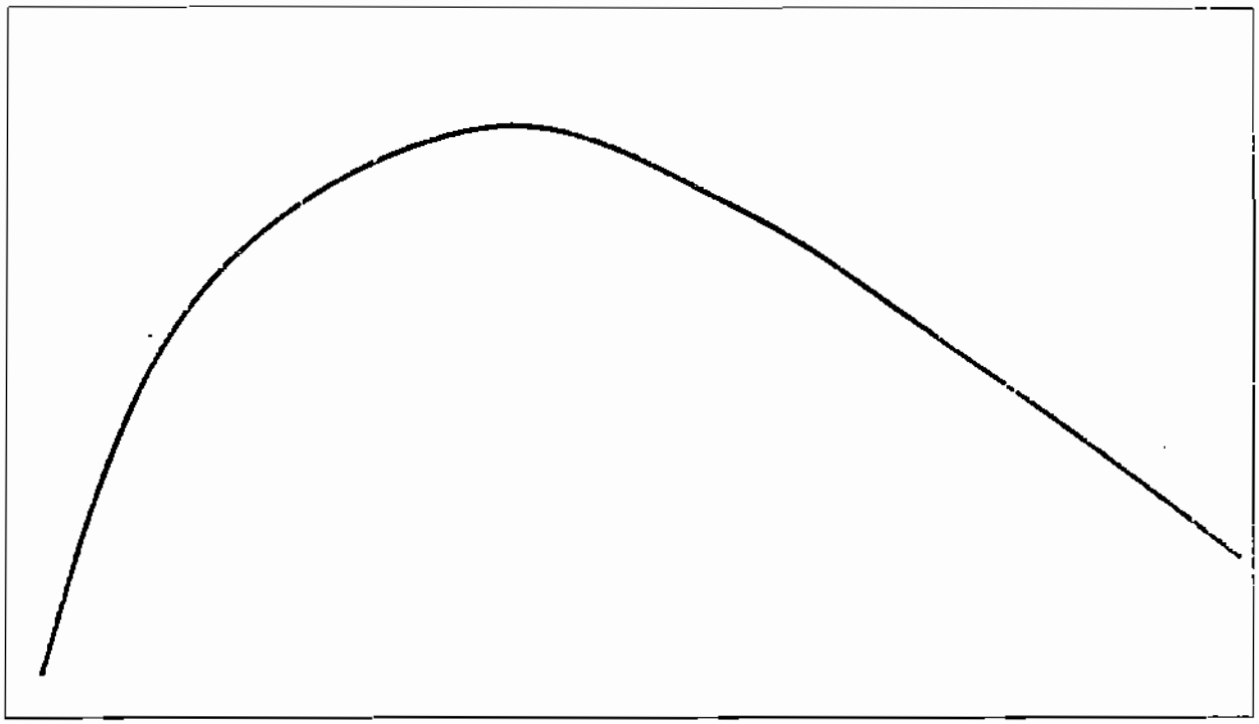


Fig.4 (hardening curves)

3) [6]

The hardening curve for an Al-Cu alloy obtained at 200°C is shown in the figure below. Indicate at various parts of the curve the source of hardening and the mechanisms operative.



4) [4]

In a tabular form compare 3 important mechanical, 2 important thermal and 1 important electrical property(ies) for the important types/families of monolithic' materials (use terms like good/bad or high/low for making the comparison).