

## Materials 2 Questions set 4

### Small scale structure of metals, ceramics and polymers, and their behaviour

Questions (i), (ii) and (iii) are on basics, including terminology.

(i) In metals processing, drawing is an example of cold-working. What is cold working? What is drawing?

(ii) Annealing is another type of metals processing. What is annealing?

(iii) What are the three polymer classifications? Give an example of each type and sketch the structure.

1. Consider a steel paperclip.

(a) Bend it. What happens?

(b) Bend it back. What happens?

(c) Bend it repeatedly. What happens? We have not covered this in the course yet, but what ideas do you have as to why this happens?

(d) Why are these behaviours important in engineering?

2. Consider a steel paperclip:

(a) Sketch and label the microstructure, add a scale bar to your sketch. We have not covered this explicitly in the videos, however we have covered this subject sufficiently for to do make a simple sketch.

(b) Sketch and label the unit cell of the crystal structure, add approximate dimensions to your sketch.

(c) Explain the behaviour you observed in Q1 by considering the processes that occur at on small (microstructural) scales. Use annotated sketches to describe your answer.

3. What are the attributes (properties, design and manufacturing criteria) for a paper clip? Discuss whether they are essential or desirable.

What are suitable materials for paper clips?

4. Get a strip of polyethylene (PE) (cut from a PE bag).

(a) Pull it in tension. What happens?

Explain why by considering the processes that occur at on small (microstructural) scales.

(b) If you repeat the experiment, do you get the same results?

How can you explain the behaviour?

5. Post-it notes adhere well to many surfaces. Explain why this happens using annotated sketches. What reduces, or prevents, them adhering?