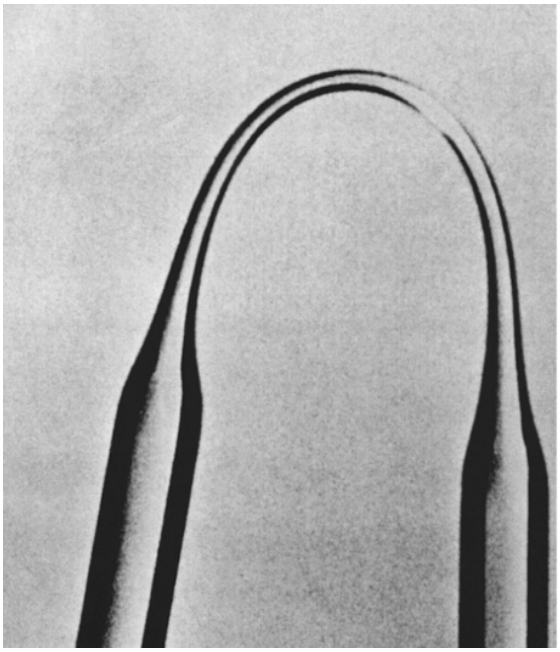
# Materials 2 Questions set 7
# Composite materials, and including cellular solids

1. For fibre reinforced composites, to determine properties e.g. the elastic modulus we can use the rule of mixtures. Imagine you're asked to explain both the upper and lower bound rule of mixtures to a first year engineering student who's not familiar with it. Design a way to illustrate/convey both forms of the rule of mixtures using 'everyday' materials. Use a sketch to convey your answer.

2. The rule of mixtures approach works with ideal/'perfect' composites. But in practice materials are more complex and very rarely perfect. Make sketches to show what aspects and imperfections can affect composites in practice.

3. Below is an image of a bent glass rod
(from JE Gordon, New Science of Strong Materials, 1968)



In an earlier seminar we bent a steel paperclip, which looked similar to the shape of the glass rod above. But typically, you can't bend a normal piece of glass, why not? How could this behaviour link to composites?

4. Give three examples of the use of composite materials in engineering applications, and briefly consider their advantages and disadvantages (use a few bullet points in your response).

5. a) Give examples of cellular solids* (foams, porous materials) that are used in engineering because of their chemical, mechanical and thermal properties (use a few bullet points in your response).

b) Investigate and discuss one cellular solid, or porous material, what are its advantages and disadvantages/challenges?
Ideally, choose something that interests you, this can be in engineering, or outside conventional engineering. Use the WHAT framework to structure your response; but you can go into more depth in an aspect(s) of the WHAT framework, if that interests you. Use bullet points and sketches appropriately (aim to write about a page).

*NB in the course we use the terms cellular solids, foams, porous materials to mean materials with holes or pores. The specific terminology, and its usage, varies between the different technical domains where the materials are used.

6. FASTBLADE will test many tidal turbine blades during its operation. This will help to accelerate the development of a very promising renewable energy technology. At the same time, however, most blades being developed are manufactured using thermoset polymers, which are not recyclable. How can we dispose of the thermoset blades at the end of their life? How can we improve the sustainability of both tidal turbine blades and wind turbine blades? Write about three bullet points in response to each question.