

PHYSICS COLLOQUIUM

Prof. Steve Eichhorn of the University of Exeter.

“Natural and Bio-inspired Materials: Mechanics and Interfaces Explored”

This talk will cover studies on a range of natural and bioinspired materials, including shells, fingernails and composite materials made using cellulose nanostructures. Particular emphasis will be placed on the role of orientation and interfaces present in these materials, and the ability to control and measure these parameters. Two case studies of natural materials will be reported where we have probed residual stresses in seashell structures using X-ray diffraction and measured the effects of moisture on the mechanics of fingernails. The mechanical properties of bio-inspired materials have also been studied by the group. Here we have, in collaboration with chemists, mimicked the crack bridging effects seen in nacre by incorporating synthetic polymers into single crystals of calcite. We have also used the interfaces between cellulose nanowhiskers and resin materials to generate switchable stiffness and shape memory materials. Emphasis on this part of the talk will be on the use of nanoindentation and Raman spectroscopy techniques to probe the mechanics of these bio-inspired materials.