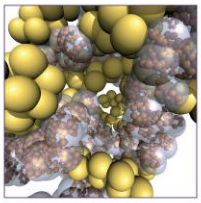

Physical Aspects of Polymer Science
8–10 September 2015
Manchester Institute of Biotechnology
Manchester, UK
http://paps15.iopconfs.org

Tuesday 8 September, Session 2, 16:20 – 16:40

Structural colour: Making white from biological inspiration

S L Burg[1], A J Parnell[1], A Washington[1], O O Mykhaylyk[1], A Bianco[1], S Prevost[4], J P A Fairclough[1] and R A L Jones[1]

[1]University of Sheffield, UK, [2]ID02 Beamline, European Synchrotron Radiation Facility (ESRF), France

The scales of *Lepidiota stigma* beetles are exceptionally white and accomplish this feat with a remarkably thin layer, with thicknesses ranging from 5 µm-15 µm. The nanostructure responsible for the scales' whiteness is a porous network of chitin and air, it is interesting to note that chitin is a low refractive index material ($n \sim 1.56$). Further investigation of this morphology is necessary to understand how the orientation, shape and anisotropic ordering of the chitin network accomplishes such high optical scattering strength. Carefully cut cross sections of the *Lepidiota stigma* scales were examined with scanning and transmission electron microscopy to shed light on how the chitin filaments are ordered in space. Additionally, in an effort to further understand the optical properties of the scales, ultra small-angle X-ray scattering (USAXS) data was obtained.

With an understanding of the structural white from the *Lepidiota stigma* beetles' evolutionally optimized structure, the focus could move to synthetic routes to mimic it. The most promising method involved using a polymer solution with an additional solute to induce micro phase separation. The process could be tuned by adjusting the solution components and concentrations. By screening parameter space it was possible to find the optimum conditions where the resulting films were white and porous. The films, like the beetle scales, were then examined using SEM and USAXS. The resulting comparison of the two structures shows that the synthetic films did have strong similarities to the *Lepidiota stigma's* scales. However, the scattering data did reveal differences in the porosity and orientation implying that the films need to be further optimized to achieve the scattering power of the beetle scales at the same comparable thickness.