

## Photographs

*Bob Pendlebury describes a new ICI polymer fishing line suitable for mendacious anglers. Don Casper peruses this year's posters, while Norbert Stribeck reminisces with Greg Diakun about the SAS96 meeting in Campinas. Patrick Fairclough receives his prize, confirming the Ryan group domination of the polymer poster competition.*

## Perfect Plastic Products Need Good Crystal Management Proceedings of Royal Society 1997

It is all too easy to take for granted something as simple as plastic sachets used in coffee and tea machines. In reality, it can take some complex polymer science to get the right material properties for the sachets and, just as important, to maintain those properties from batch to batch. Polymer processors now have a better understanding of how they can achieve these goals thanks to a research project carried out by the Manchester Materials Science Centre at UMIST and the Daresbury Laboratory of the Council for the Central Laboratories of the Research Councils (CCLRC).

The ROPA project was on show at this summer's prestigious annual summer exhibition at the Royal Society. The exhibit was a 2/3 scale model of the experiment on beamline 16.1 at the SRS. To make the exhibit work visually the data was played back from video on screens placed in the detector housing. There were many other interesting exhibits at the exhibition but there was little time to enjoy them as the days were spent explaining the research to members of the public (mainly OAPs and schoolchildren) and the evenings dedicated to Fellows and their guests.

The UMIST team, Nick Terrill, Patrick Fairclough, Bob Young and Tony Ryan, in collaboration with Liz Towns and Ernie Komanschek of CLRC investigated the way in which polypropylene crystallises during extrusion to produce polymer films using 2D SAXS/WAXS during extrusion. Analysing the scattered radiation allowed the UMIST group to create what were in effect movies of what was happening inside polymers as films formed through extrusion.

Crystal growth itself is well understood. Indeed, as Tony Ryan points out, it is a part of undergraduate

teaching. Nucleation is another matter. "Understanding of the nucleation step is far from satisfactory" says Ryan, who has just moved to Sheffield University along with Fairclough and Terrill. So they decided to study this in a ROPA project.

The team made both small and wide angle scattering measurements on polypropylene and other polymers. The researchers built an extruder that let them study the polymer in conditions like those produced during commercial processing. Wide angle X-ray scattering (WAXS) allows researchers to study the development of structure at the atomic level while small angle X-ray scattering (SAXS) is suitable for studying the larger length scales associated with orientation of the polymer crystals. CCP13 software is used to extract the information from the noisy data. One surprise finding of the work on the SRS was that there were signs of long range order developing before crystallisation began and created short range order. There are two papers in press, one dealing with the experimental observations and the other outlining a phenomenological density of states theory for spinodally assisted crystallisation. These papers should provoke some controversy and energise the academic field of polymer crystallisation for some time.

The research has not only added to the understanding of the process of polymer crystallisation, it has already produced commercial benefits. A company making sachets for coffee vending machines has improved its products thanks to the better understanding of polymer processing. As a result of the UMIST work, the sachets now break and deliver the contents in a more controlled way.

Tony Ryan