Intertek MSG

Polymer Characterisation Capabilities

The physical and chemical properties of polymers are strongly influential on the behaviour of these materials in application. Characterisation of these properties, combined with the knowledge of how they influence product performance, can aid understanding of both your own and your competitors' products.

Intertek MSG is able to characterise many aspects of these often complex materials and has much to offer companies that are seeking to prove or improve the effectiveness of their products or understand what routes competitors' are taking. It works with clients who manufacture, use or modify a broad range of plastics, synthetic and natural polymers. Indeed, this is the traditional heartland of the group, in addition to supporting the broader chemicals industries. MSG's high-level capability includes instrumentation and expertise appropriate to characterisation and problem-solving in the materials area.

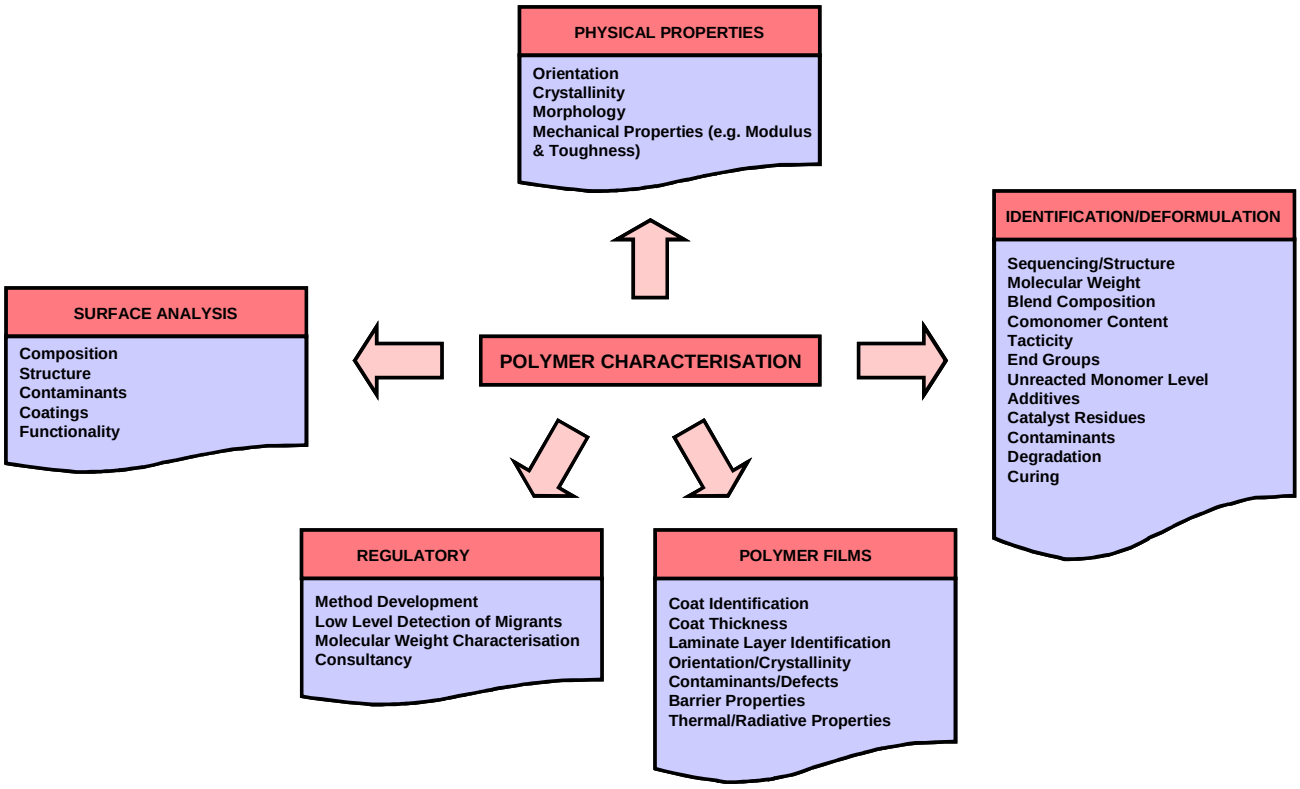
Some of the activities within MSG which are relevant to the characterisation of polymeric materials are described in the diagram and examples below**.**

Chemical Composition

The spectroscopic facility offers an insight into materials chemistry, particularly in the area of polymer characterisation. Experimental and spectral interpretation expertise covers a wide range of polymer types including acrylics, urethanes, polyesters, polyaromatics, polyolefins and many more.

Detailed chemical information is available including molecular structure, impurities, additives, quantitative chemical composition, monomer sequencing, tacticity, conformation, molecular weight, size and shape, and end group identification and quantification. XPS and Tof SIMS provides detail on surface chemistry.

In addition to the standard NMR, mass spectrometry (e.g. MALDI-TOF), separation science (e.g. triple detector GPC, HT and aqueous GPC) and vibrational spectroscopy capabilities, there are also online GPC-NMR, GPC-MS with GC- and LC-MS facilities. These techniques are particularly powerful for the deformulation of complex competitive formulations.



Characterised by Expertise

www.measurementscience.co.uk
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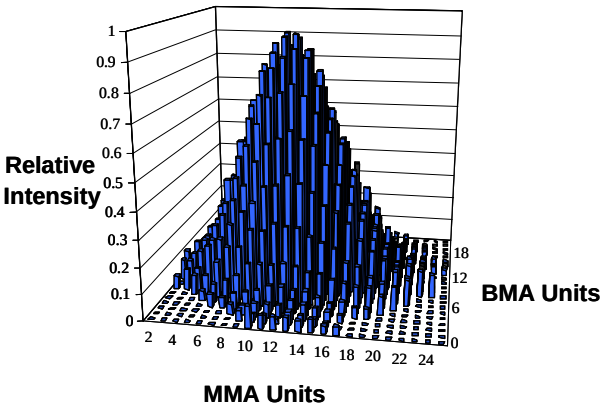
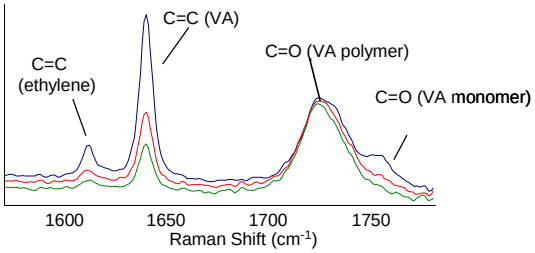
An example of the detailed structural information that ay be gleaned from complex systems is shown below (from the MALDI-TOF data obtained from a block copolymer). This shows the full distribution of oligomers in this material in a 3-D plot.

Distribution of MMA/BMA Block Copolymer

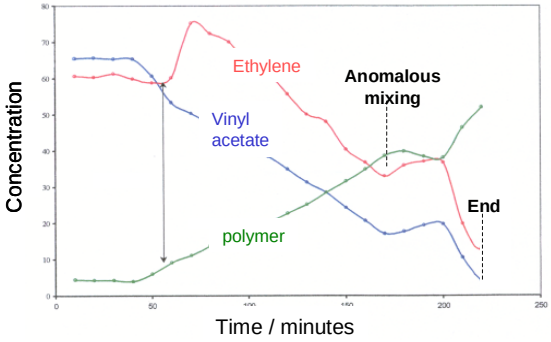


In-Situ Polymerisation Monitoring

Raman spectral changes during reaction



EVA reaction profile



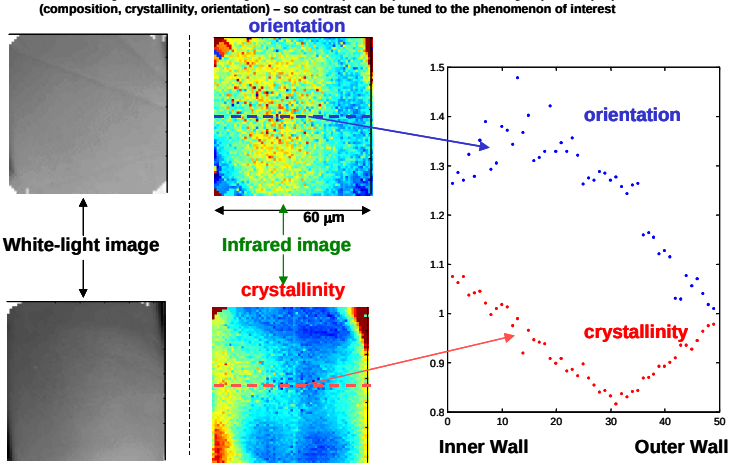
Vibrational spectroscopy techniques can allow the on-line or near-line monitoring of polymerisation reactions, following the depletion of monomer(s) or build-up of polymer or copolymer in order to better understand and control reactions. An example showing characterisation of ethylene-vinyl acetate polymerisation by Raman spectroscopy is shown below. The consumption of the different functional groups can be followed and quantified in real time, and as an added bonus the mixing efficiency can be directly observed in the reactor.

Crystallinity and Orientation

Polymer articles such as films and bottles must have the correct degree of crystallinity and molecular orientation to impart the required strength and toughness. MSG are acknowledged leaders in the development of infrared and Raman techniques for measuring these properties in finished polymer articles. The example below shows a quantitative micro-infrared image of the crystallinity and orientation variations through a bottle wall. There are significant, and opposing, changes in these properties on traversing the wall thickness. This information cannot be obtained by traditional optical microscopy alone.

Infrared imaging of crystallinity and molecular orientation in polyester bottles

Infrared image is constructed using intensities of specific spectral bands relating to product properties (composition, crystallinity, orientation) – so contrast can be tuned to the phenomenon of interest



Orientation and crystallinity clearly visualised in spectroscopic but not white light images. In this case there are clear and opposite gradients in crystallinity and orientation through the bottle wall

In addition, MSG examines the processibility, rheology and a number of properties of polymers (see separate flyers for more detail).

If there is any interest in the above capabilities, please address your enquiries to Dr Allan Stewart by the following means:-

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