

PL4

Seeing Processes - Process Imaging Metrology

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A wide range of real time in-process precision measurements have been researched and developed in our laboratories. These are aimed at quantification of process flows, process parameters and products for:

- enhanced process measurement,
- process understanding, design and control,
- assisting the development of new process technologies, and
- validation and development of computer modelling of processing.

Our techniques include:

- rheology (in-line and on-line);
- rheo-optics (in-line);
- optical imaging of products (in-line and at-process imaging of dimensions, shape changes and defects, and off-line e.g. surface profilometry);
- ultrasound (in-line longitudinal and shear wave measurements);
- melt temperature fields (thermocouple meshes, infra red and ultrasound measurements);
- at-process vibrational and fluorescence spectroscopy (in-line near infra-red, Raman and UV fluorescence; and on-line mid infra-red);
- energy (high sampling rates for process measurements) and
- small angle neutron and x-ray scattering (chain orientation/configuration, stress enhanced crystallisation studies - at external beam lines).

Quantified process imaging is a challenging area, but significant progress has been made. Results for imaging metrology for polymer melt processing are presented, including melt velocity fields using particle tracking velocimetry and laser sheet lighting (complemented by small angle neutron scattering) and 3-d visualisation; micromoulding product assessment; product surface feature assessment; blown film bubble feature measurement; and strain/strain rate monitoring for solid phase deformation processing.

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