Future Research Opportunities

Martin Rides
Future research opportunities

• In-process rheometry – development of standards
  Alan George, Porpoise Rheometers

• Measurements for the prediction of naturalness (MONAT)

• Materials Metrology Programme - Materials 2007+
In-process rheometry – development of standard
Alan George / Martin Rides

Issue:
Need for greater acceptance of in-process measurement technology, through standardisation, to improve uptake

Proposal:
to develop ISO standard for in-situ measurement of rheological behaviour of polymers and correlate with melt flow rate values

NPL studio project to be developed to pursue this goal
Presentation

In-Process Rheometry

Alan George
Porpoise Rheometers Ltd
(http://www.porpoise.co.uk/)
Approach and aims

• Demonstrate the use of on-line rheological equipment for monitoring extrusion processing and the potential for product quality control and process control

• Use of commercially available instrument for measurement on extrusion type processes
On-line rheometry - Porpoise extrusion trials

Schematic of Porpoise P3 extrusion rheometer
On-line rheometry - Porpoise extrusion trials

Porpoise Viscometers’
P3 extrusion rheometer
Porpoise on-line rheometer mounted on a compounding line
Basic theory

• Theory same as for capillary extrusion rheometry

• No entrance pressure drop correction - same as MFI

• Gear pump controls flow rate
• Variation measured on-line of the MFI of a filled polyolefin over a 2 day manufacturing run
On-line rheometry - Porpoise extrusion trials

- Batch to batch variation of a filled polyolefin (polymer batches supplied from different reactors)
On-line rheometry - Porpoise extrusion trials

Concluding remarks

• Near immediate process and material consistency measures
• Data can be used for process control and materials quality control
• Low level of operator input
• Significantly higher sampling rates than practicably possible by MFI
• Residence times can be reduced through careful design of rheometer positioning and of material through-put profile
In-process rheometry

**Issue:**
Need for greater acceptance of in-process measurement technology, through standardisation, to improve uptake

**Proposal:**
To develop studio project to enable UK to lead activities in standardisation of in-process rheological measurement

**Studio project criteria:**
- Approx. 1 year duration
- 50% industrial contribution (15% cash, 35% in-kind (industrial trials, meetings, materials and equipment supply, etc) / 50% DTI funded
- At least 3 industrial partners
Measurements for the prediction of naturalness (MONAT)
Key objectives

• Understand neurological and psychological responses involved in perception of ‘naturalness’
• Identify relationships between physical properties of material and perceived ‘naturalness’
• Determine most appropriate physical measures for modelling perception of ‘naturalness’
• Model relationships between physical attributes, sensory network and higher-level cognitive functions to predict perceived ‘naturalness’
Measurements for touch perception

- Material hardness (compressibility)
- Surface roughness
- Surface friction
- Tensile properties
- Thermal conductivity, heat capacity etc
Studio project

• To develop studio project to enable UK companies to benefit from EC Framework Programme (FP6)

• Studio project criteria
  – Approx. 1 year duration
  – 50% industrial contribution (15% cash, 35% in-kind (industrial trials, meetings, materials and equipment supply, etc) / 50% DTI funded
  – At least 3 industrial partners
Materials Metrology Programme - Materials 2007+

Selection of short-listed projects:

- Fluid properties for micro-processing – Martin Rides
- Diagnostics for Measuring and Modelling Dispersion in Nanoparticulate Reinforced Polymers – Bill Broughton
- Moisture in materials - development of measurement capability – Stephanie Bell

Programme launch - April 2007

Annual “rolling” formulation – keep ideas flowing