

A NOVEL MICROWAVE-ASSISTED INJECTION MOULDING OF POLYMERS

O. Alothman and R.J. Day, Manchester Materials Science Centre, Grosvenor Street, Manchester M1 7HS

Injection moulding of polymers is a relatively old technique that has seen few major changes since its introduction. Essentially polymer drops from a hopper onto a screw. The screw then turns propelling the material through several zones where it is heated, compressed and then feed into a space at the end of the barrel. As the screw turns it retracts thus making room for the molten polymer to be stored. The polymer is injected into a mould by the screw which is pushed forwards by a hydraulic cylinder.

The design, although popular, has a number of intrinsic problems:

- High radial thermal gradients are present in the melt due to the poor thermal conductivity of polymers. This can then lead to problems in the moulding.
- Heating is provided by heater bands around the outside of the barrel leading to a huge loss of energy in the form of heat to the surroundings.
- Heat is also generated within the polymer by shear heating. This is difficult to control and can lead to degradation of some heat sensitive polymers during processing.

In order to minimise these problems, electromagnetic heating is being used to provide a pool of molten polymer without using a heated barrel or screw. Hence the problems of heat loss, poor thermal conductivity and shear heating are considerably reduced. An existing injection moulder has been modified to allow a microwave heating device to be attached to it. This feeds the polymer into the end of the screw from where it can be injected. A thermocouple mesh will be used to monitor the temperature and velocity profile of the melt during injection enabling evaluation of the new process and comparison with existing technology.