Thesis Title	Design and Development of Experimental Apparatus for Determination of Melt Temperature Profiles in Flowing Polymer Melt in Injection Moulding
Thesis Credits	15
Candidate	Mr. Watcharakon Chaiwattanpipat
Supervisor	Dr. Narongrit Sombatsompop
Degree of Study	Master of Engineering
Department	Materials Technology
Academic Year	1999

Abstract

This work aims to design and manufacture a novel temperature sensor and an experimental apparatus, that can be used for the determination of temperature profiles of various polymer melts flowing in the barrel, near the nozzle entrance, of an injection moulding machine. The efficiency and capability of the sensor are also considered. With this type of sensor, the melt temperature could simultaneously be measured at various radial points across the barrel diameter, all the measurements being taken using a high speed data logging system coupled to personal computer. The sensor is simple and raliable, and gives reasonable and accurate temperature readings. The general results suggested that the melt temperature changed continuously with time, injection speed, polymer type and concentration of glass-fibres. The changes in melt temperature are considered as regards shear heating, heat conduction, residence time and the flow occurring in the barrel of the injection moulder. The melt temperatures across the duct channel are not uniform, two high temperature regions being observed; at the centre (r/R=0.0) and half the duct radius (r/R=0.6).

The increase in melt temperature during the flow ranges from 2 to 10 °C, varying by injection speed, polymer type and glass-fibre content. It was found that the greater the injection speed the higher the melt temperature increases. The higher the glass-fibre content the greater the melt temperatue rise, at 80% w/w glass-fibre reulting in 18 °C temperature rise. The temperature

rise for glass-fibre filled polymer melts is due to shear heating between polymer and polymer, and polymer and glass-fibre. For a given test condition, differences in temperature rise for various polymer melts are associated with thermal properties of the polymers.

Keywords : Temperature Profiles / Polymer Melt / Polymer Rheology / Injection Moulding / Shear Heating / Polymer Melt Flow