Glass Fibre Manufacture

A STUDY OF TEMPERATURE DISTRIBUTION IN RHODIUM-PLATINUM FURNACES

In work on the drawing of glass fibres from alkaline melts at the Institute for Glass Research, Hradec Králové, Czechoslovakia, a particular design of rhodium-platinum furnace, known as the Rh furnace, has been used successfully for many years. Recently, however, non-alkaline glasses have been developed and in using the same furnaces to draw fibres from these melts certain difficulties have been encountered, occurring at irregular intervals. The main trouble was caused by sudden interruptions in the drawing, leading to breaking of the fibres. A paper by two workers at the Institute (M. Kucera and A. Macenauer, *Veda a Vyzkum v. prum. sklar*, 1957, **3**, 53–57) describes investigations carried out on the effect of one variable, temperature distribution in the molten glass, on the quality of the fibres.

The furnace used, based on a British design, weighs 2700 g and is in the form of a tank of dimensions $232 \times 72 \times 90$ mm. The tank narrows, like a funnel, towards the base where the nozzles are situated, the depth of the funnel being 30 mm. One of the main factors in the successful production of continuous glass fibres is the maintenance of constant temperature at the nozzles and of uniform heating within the interior of the furnace. In the ideal case the maximum temperature should occur at the solid-melt interface and the temperature should fall uniformly throughout the melt to an optimum value at the nozzles, guaranteeing the best glass viscosity for the drawing conditions. Isotherms should exist within the glass melt, parallel to the base of the furnace.

The temperature of the molten glass was measured at 62 points situated in selected lateral and longitudinal planes within the furnace. The measurements were made by means of a platinum : rhodium-platinum thermocouple inserted into a cylindrical platinum shoe with an adjustment to enable the temperature to be read at predetermined levels in the furnace.

The results showed a range of temperatures from 930 to 1190°C within the melt, but with an extremely irregular distribution. In no sections were the isotherms parallel to the base of the furnace and the distribution varied widely from one parallel section to another. The temperature at the nozzles was not uniform and in some instances "pockets" of lowered temperature were formed within the glass mass. It is easy to see that such "pockets", on travelling through the melt to the nozzles, will cause interruptions in the drawing, since the glass viscosity will be continually changing.

It thus appears evident that the breaking which occurred in the fibres was due to uneven temperature distribution. This lack of temperature uniformity may be due to uneven heating of the furnace, inhomogeneity in the glass or irregularity of glass addition. Even when care was taken to ensure uniform heating and regular glass additions, breakages still occurred. The cause in this case was either glass inhomogeneity or some defect in the design of the furnace such as excessive width or too great a depth of glass for the purpose of drawing. As a result of these experiments, alterations have been made in the design of new furnaces for automatic operation, but no details are given.