Production of Optical Glass Fibres

ION EXCHANGE IN A DOUBLE PLATINUM CRUCIBLE

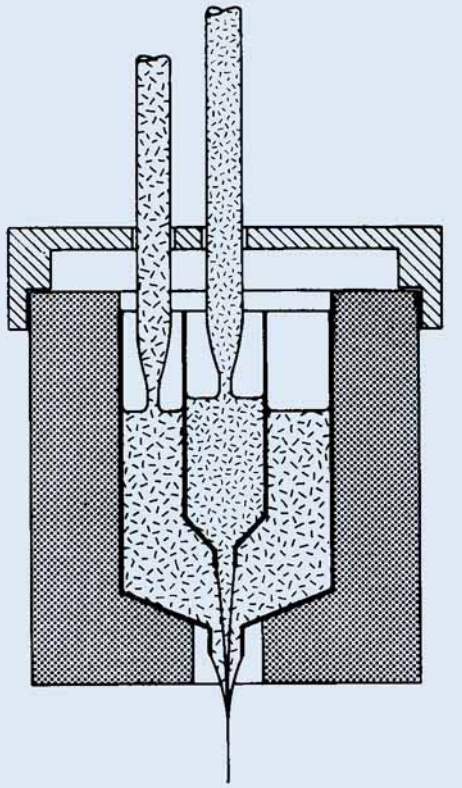
Since the development of the laser the concept of using optical fibres for telephone transmission has received a great deal of attention, but the manufacture of such fibres to the necessary standards has presented difficulties. A fibre for optical communication must not permit excessive radiation to escape sideways, absorption and scattering losses must be minimal, and the shape of the light pulse must be preserved over long distances.

Doped silica glass can be employed, but an alternative procedure involving the use of soft multi-component glasses is also satisfactory, while the techniques of conventional glass manufacture can be used in the latter case, employing a double crucible in pure platinum.

A report from Philips Research Laboratories at Eindhoven (H. J. M. van Ass, P. Geittner, R. G. Goesink, D. Küppers and P. J. W. Severin, *Philips Tech. Rev.*, 1976, **36**, (7), 182–189) describes a double-crucible method in which two different glasses are employed on a continuous basis—an obvious advantage for commercial production. Two types of multi-component glass of different refractive indices are used, the glass with the higher refractive index forming the core of the fibre while the other forms the cladding.

Both the glass manufacture and the fibre-drawing process are carried out in dust-free clean rooms. The raw materials, of high purity, are first melted in a platinum crucible, purified gas being blown through the melt to improve its homogeneity. Rods of circular cross-section, about 5 mm in diameter, are then drawn upwards through rollers.

The final production is carried out in the double platinum crucible, as shown in the diagram. Rods of the core glass are fed into the inner crucible and rods for the outer layer into the outer crucible. Melting must be conducted slowly and at a temperature sufficiently high to prevent bubble formation. The glasses then flow out at about 800°C, and the required ion exchange between core and cladding takes place in the region between the outlets of the inner and outer crucibles where the rate of flow is very low. This composite glass is then drawn to 100 μm fibres.



The double platinum crucible for the production of optical glass fibres. The inner rod of alkali-germanosilicate glass has a high Na^+ ion content and a high refractive index, while the outer rod of the same glass but with a high K^+ ion content has a low refractive index. Between the outlets of the concentric crucibles there is an exchange between the Na^+ and the K^+ ions, giving a smooth variation of the refractive index profile in the resulting fibre