ones containing lead ions) nitric acid is used. Large amounts of old melts are more easily removed with a trepanning drill before the use of the fusion mixture.

Apart from cleaning, precious metal components require little maintenance. Platinum parts which distort can be annealed and bent or hammered back into shape, although too much working is not desirable, and if much work must be done the material should be annealed several times. Annealing and welding are conveniently done with a gas torch but care must be taken to maintain an oxidising rather than a reducing flame.

This article discusses the main uses of the platinum group metals in crystal pulling. The ideas behind the use of the various components are given in the references so far cited and a comprehensive review is given in reference 10.

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# Platinum in Crystal Growing and Optical Fibre Production

Since the advent of solid state lasers in 1960 the optical and electronic industries have made significant developments in the preparation of novel oxide single crystal materials for devices such as light modulators, second harmonic generators and bubble domain memories. A further advance in materials technology is the development of optical fibre waveguides for communications. One factor common to these devices is that they are all produced with platinum apparatus.

Several grades of platinum are available for the fabrication of crucibles. The selection of a suitable grade of platinum is determined by the degree to which the optical or electrical characteristics of the end-product are influenced by specific trace impurities, and the physical and chemical properties of the crystal melt.

Where mechanical strength and thermal stability are important, as in general analytical work, platinum selectively doped with rhodium and iridium is used, although rhodium is slowly leached from the crucible by corrosive fluxes and highly reactive melts.

Platinum used for both melt and flux-melted crystal growing should be as free as possible from these and other metals, which may be detrimental to certain optical and magnetic devices. In the case of barium titanate, the ferroelectric Curie temperature may be lowered, whereas in lithium niobate the susceptibility of the crystals to laser damage may be increased. Rhodium also substitutes in the lithium niobate lattice, causing absorption in the visible region of the spectrum.

In order to reduce to an absolute minimum trace metal contamination of the crystals, it is advisable to employ crucibles fabricated from a thermocouple grade of platinum known as Thermopure. This material is, however, comparatively soft and if a thin wall is used the crucible may need to be reinforced at the rim or to be supported in a ceramic sheath.

In optical transmission fibres, absorption in the near and infra-red spectral region is controlled largely by sub-p.p.m. levels of the first row transition metal ions. Since the purity of the bulk glass is so critical it has been necessary to introduce an ultra-high purity Fibre-optic grade of platinum to meet the stringent requirements of this comparatively new technology. This Johnson Matthey material has a total metallic impurity level of less than 10 p.p.m. (total iron plus copper content less than 5 p.p.m.). P.M.W.