

# Platinum group metals in glass manufacturing

This article by Jonathan Butler\* explores the use of platinum group metals in glass manufacture, key trends and dynamics in the market, and prospects for the future.

For many decades, the glass industry has been a major user of platinum and rhodium in the manufacture of glass fibre, display glass, and types of specialty glass. These platinum group metals (PGM) have high melting points, are resistant to corrosion and are mechanically strong – properties that make them uniquely well-suited to the aggressive environment of molten glass. In addition to extending the lifetime of components, PGM coatings and fabrications allow defect-free surfaces to be produced. These are crucial for high-quality optical and display glass such as that used in liquid crystal display (LCD) panels. An important advantage of PGM in glass manufacture is that typically between 95 and 98% of the metal can be recycled and reused.

## Platinum group metals

Platinum and platinum-rhodium alloys are used in the linings of vessels that contain, channel and form molten glass, as well as in self-supporting fabricated parts and in coatings on surfaces such as ceramic stirrers, bowls and orifice rings. The high melting point of PGM and their resistance to corrosion gives them unique properties of strength and durability in the highly aggressive environment of molten glass. Where platinum is alloyed with zirconia, the mechanical strength of linings and fabrications can be further enhanced. This enables the operating lifetime of equipment to be extended, can improve return on investment and lower total energy requirements. Importantly in



▲ Platinum group metals are used for high-quality optical and display glass used in LCD panels.

applications where high-purity glass is required, it ensures the end-product is free of defects. A further advantage of PGMs is that they are recyclable: Typically 95 to 98% of the metal used can be recycled. This is mostly re-used in similar glass applications. Increasingly, iridium is also used as an alloy to complement platinum and rhodium in fabrications and linings, where it can be used in both oxidising and reducing environments and offers high mechanical strength as well as creep resistance.

Johnson Matthey's latest survey of the PGM market, *Platinum 2011*, shows that in 2010, 345,000 ounces of platinum were used in the glass industry. The market for PGM in glass manufacture tends to be cyclic: A large amount of demand comes from new glass plants, driven by technology choices, consumer trends and economic growth. Recycling periodically returns metal from older manufacturing facilities. This has lent

interesting dynamics to the market in recent years, which are explored below for two of the main applications of PGM in glass manufacturing: Display glass and glass fibre. In the last year or so, additions to glass fibre and LCD glass manufacturing capacity, particularly in Asia, more than offset sales of metal back from closed plants.

## Display glass - current market

PGM components have historically been used in the manufacture of display glass, such as that used in televisions and computer screens. In the last decade, there has been a shift in the type of technology used in television and computer displays, from cathode ray tube (CRT) technology to thin-film transistor LCD (TFT-LCD). PGM components are essential in the manufacture of both, but the transition between the two has lent interesting dynamics to the use of PGM in glass.

Active-matrix TFT-LCD panels are used in most television and computer displays on the market at present, and PGM components are essential in their manufacture. The substrate in TFT-LCD panels is a thin sheet of non-alkali, ion-free glass on which the TFT structure is fabricated. The glass substrate must be extremely smooth, of uniform thickness and not contain any charge-carrying particles that could migrate into the TFT structure and reduce image quality in the finished product. Platinum and rhodium linings are therefore used to channel the molten glass throughout

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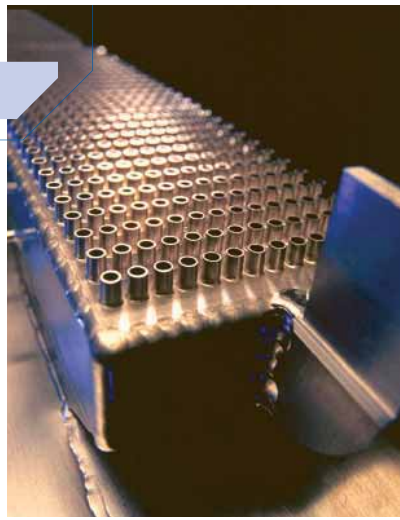
## Precious metals in glassmaking

the manufacturing process. Melting tanks, refining channels and stirring cells, where the raw materials are mixed and the glass is homogenised, must be able to withstand temperatures of up to 1650°C, while remaining inert in order to ensure the finished product is defect-free. Up to a tonne of platinum can be used in the latest generation melting tanks, however almost all of this metal is recycled at the end of the tank's life.

In the last year or so, two technology trends have affected the use of PGM in display glass manufacturing: A move by consumers away from older CRT technology in televisions, monitors and other display units; and the growth in consumer demand for TFT-LCD panels, particularly in mobile devices such as hand-held tablet computers.

CRT display technology, which was historically a strong demand area for platinum-rhodium fabrications and coatings, has been in decline for several years in the face of consumer trends towards flat panel screens for aesthetic reasons and the need for ever thinner screens for use in mobile phones and laptops. This has brought about the closure of old CRT plants, which has returned PGM for recycling, as well as a large increase in new plants being built to manufacture TFT-LCD glass. While CRT production is expected to cease by 2015, TFT-LCD glass manufacture is increasing rapidly, particularly in China.

Unit sales of TFT-LCD technology for flat-panel displays and mobile devices have grown rapidly over the past few years with the introduction of inexpensive and ever-larger panels. Most TFT-LCD panels use two sets of high-quality display glass coated with electrodes between which the liquid crystals lie. Some devices use a third layer of thin, high-strength sheet glass as



◀ The glass fibre industry is a major user of PGM. It is manufactured by drawing molten glass through a platinum-rhodium vessel (bushing) with hundreds of precisely dimensioned holes in its base.

a protective cover, which offers greater durability and scratch resistance to hand-held devices with touch screens.

Falling prices of TFT-LCD screens, combined with an improved economic outlook, means that LCD television sales are poised to grow strongly over the next few years. Added to this there is expected to be large consumer uptake of portable electronic devices. Considerable TFT-LCD manufacturing capacity was added in 2010, particularly in China, which helped increase demand for platinum and rhodium. The rapid uptake of TFT-LCD screens represents considerable new demand for PGM in the production of multiple layers of blemish-free glass.

### Glass fibre

The glass fibre manufacturing industry is another major user of PGM. Glass fibre, used in fibre-reinforced plastics and construction materials, is manufactured by drawing molten glass through a platinum-rhodium vessel ('bushing') with hundreds of precisely dimensioned holes in its base. This allows extremely fine fibres of glass to be consistently produced. The bushing has to be able to

▼ Over the last decade there has been a shift in the type of technology used in television screens, from cathode ray tube (CRT) to thin-film transistor liquid crystal display (TFT-LCD).

withstand high temperatures and not react with the glass.

The recovery of the world economy during 2010 led to an increase in glass fibre manufacturing following two years of recession, when demand for glass fibre in construction and in the automotive sector declined. Growth in demand for platinum bushings from both new capacity and replacement of older equipment took place in 2010.

Strong, lightweight glass fibre composites are increasingly required in the aerospace, automotive and construction industries. Considerable new capacity is being installed for glass fibre manufacture, although some of the PGM requirements are being met from metal already in manufacturers' inventory in the form of decommissioned marble re-melt furnaces.

### Specialty glass

Optical glass also requires the use of PGM throughout the manufacturing process to produce flawless lenses. Pure platinum components are preferred for melting, conditioning and forming optical glass, as rhodium alloys can cause colouration of the glass. A growing area is glass for solar photovoltaic panels. Glass in this application needs to be highly transmissive and free of blemishes. As in other applications, PGM coatings are required to protect and extend the lifetime of individual process components.

### Outlook

Demand for increasingly sophisticated electronic displays, solar panels and lightweight, durable glass fibre composite materials looks set to grow in the next few years. PGM use in manufacturing glass for these various applications offers unique operational characteristics that help extend component lifetimes, reduce expenditure, and produce high-quality glass for a range of applications. ■

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