

INDUSTRIAL DIAMONDS

By a Special Contributor

Apart from their value in jewellery, diamonds have unique properties that make them ideal for many industrial and research applications. Their hardness makes them particularly valued for abrasive purposes and diamonds are widely used in drilling, grinding, cutting and polishing tools. They are used in the production of special lenses because of their optical properties, whilst the thermal/electrical characteristics of diamond have led to their use in wire drawing and heat sinks in electrical circuits.

For many years, crushed natural diamond (boart) was the only source of diamond for industrial purposes and today around 54% of the world's total mined diamond production by weight is used for industrial purposes. By value, however, natural industrial diamonds account for only some 1% of the total market value of natural diamonds. In 2000, mine production of natural diamond (gem and industrial) totalled 110 Mct worth US\$7.86 billion, and the US Geological Survey (USGS), in its 'Mineral Commodity Summaries' publication, estimates the industrial diamond component in mine production last year at 58.6 million carats (1999: 56.3 Mct). The leading producers were Australia (18.5 Mct), Democratic Republic of Congo (14.5 Mct), Russia (11.7 Mct), South Africa (6.2 Mct) and Botswana (5.0 Mct). The USGS estimates the reserve base at some 1,200 Mct.

However, today's market for industrial diamonds is dominated by synthetic stones. First developed in the 1950s by subjecting simple hexagonal carbon (graphite) to extreme heat and pressure to convert it into the cubic form (diamond), synthetic industrial diamonds soon rivalled other abrasives such as silicon carbide and fused aluminium oxide. This competitiveness was given a further boost in the 1970s with the development of polycrystalline diamond produced by sintering

together diamond particles at very high temperature and pressure. The resulting polycrystalline diamond discs are cut into a variety of shapes. A sister product, also produced synthetically, is cubic boron nitride, second only to diamond in hardness. Its prime use is in the machining of hard ferrous materials (diamond reacts chemically with these working pieces under certain conditions).

Synthetic diamonds now account for more than 90% of total supply of industrial diamonds and are preferred to natural diamond because their quality can be controlled and their properties can be customised to fit specific requirements. The US, which is the largest market for industrial diamonds, produces no natural stones but is the world's leading producer of synthetic diamonds. The USGS reports that last year US production of synthetic diamonds reached a record 248 Mct. There are only two producers, Du Pont Industrial Diamond Division in New Jersey and GE Superabrasives in Ohio. Nine other companies produced polycrystalline diamond from diamond powder and four companies recovered a total of 10 Mct of used industrial diamonds. Russia, South Africa, Ireland, Japan, Sweden and China are also significant producers of synthetic diamonds.

US apparent consumption of industrial diamonds last year was 484 Mct (1999: 328 Mct). The USGS says that most consumption was accounted for by the following industry sectors: computer chip production, construction, machinery manufacturing, mining services, stone-cutting/polishing and transportation (infrastructure and vehicles). It expects the US to be the largest producer and consumer well into the next decade.

The prices of synthetic diamonds are on a declining trend as production technology

becomes more effective and low-cost production in some countries increases. Last year, for example, the value of US imports of boart, grit, dust and powder (natural and synthetic) was US\$0.37/ct, compared with US\$0.46/ct four years previously. The competition has become too fierce for some

operators and in March this year, De Beers announced that it is closing its diamond synthesis operation at its drill-bit production facility in Ireland because of rapid price declines across most product lines and because of increased competition, especially from Far East countries.