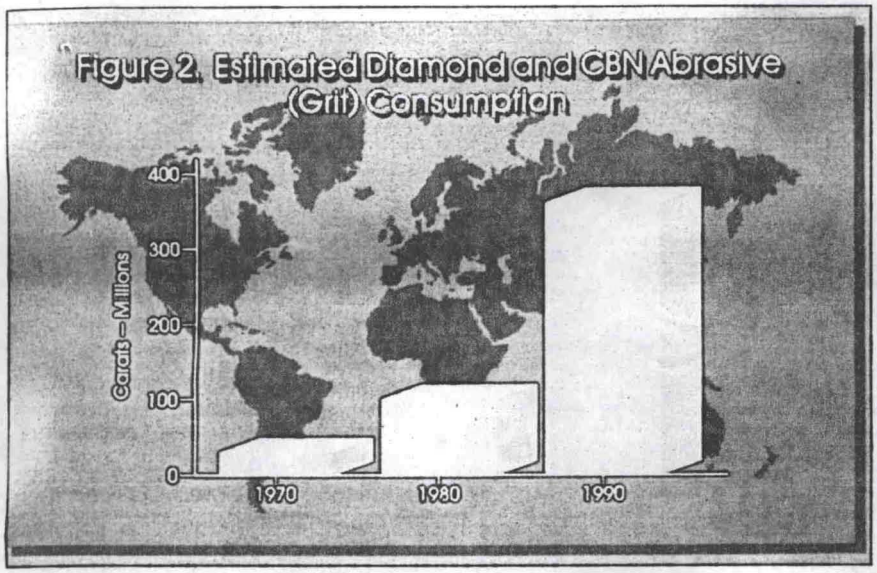


become a well-established, standard production technique in industry.

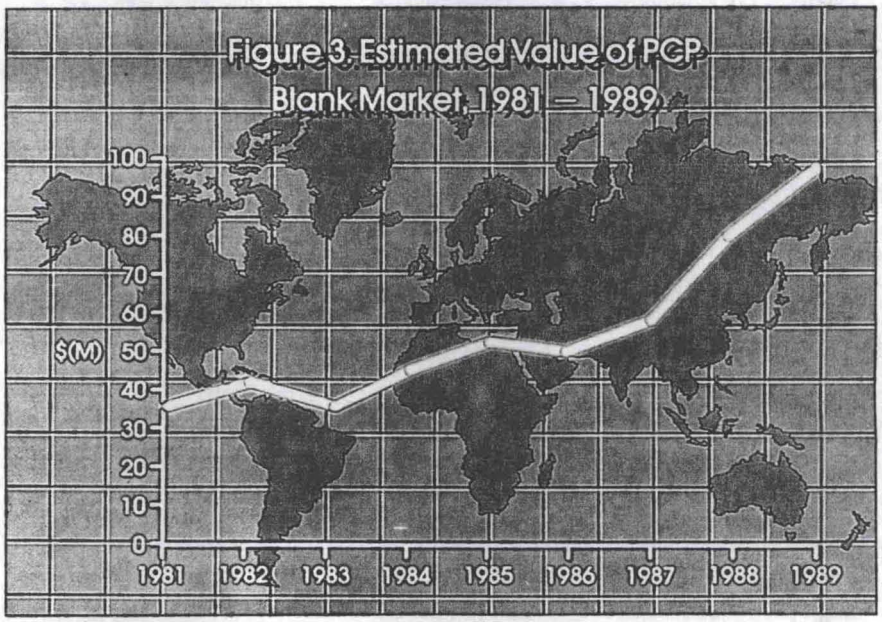
There are two important, totally different, factors responsible for the successful development of diamond & CBN abrasive usage.

The first is the continuing educational process of the various end-user markets, concerning diamond's cost-effectiveness - often a slow and difficult process, particularly for any relatively expensive product.

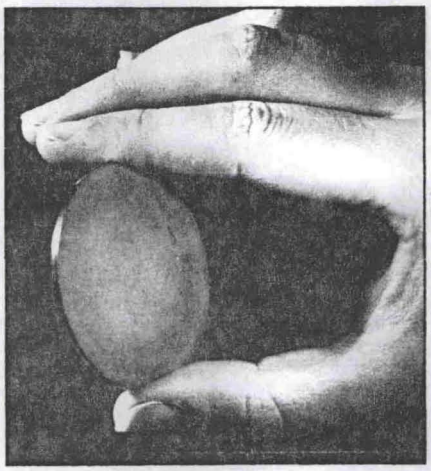
The second is the large reduction over the past 20 years in the unit cost of manufacture of synthetic diamond, and hence selling price. Whereas a volume (caratage) growth rate of 12 to 13% p.a. has been the average over this period, the equivalent figure expressed in dollar value is lower, at about 10% p.a. Further analysis, by expressing the growth in real terms by taking inflation out of the calculation, means that market growth has, of course, been less spectacular. In real terms, grit, on average, is now approximately 5-fold less expensive than it was 20 years ago.

Another factor to be borne in mind is that the efficiency of diamond tooling today is considerably greater than ever before, so that a larger volume of workpiece material is removed per unit of diamond consumed. Technological advances in the synthesis process itself and in diamond toolmaking techniques, coupled with a fuller understanding of the correct use of diamond tools, have led to this situation.

In simple terms, a single carat of industrial diamond today is not only considerably cheaper, but performs considerably better than a single carat bought 50 years ago.



Economies of manufacturing scale resulting from the fast growth in demand for synthetic diamond grit have, over the years, led to commercial development of larger high pressure manufacturing systems by synthetic diamond suppliers such as De Beers. The diamond tool makers, and hence the user industries, have benefited from these lower unit costs.

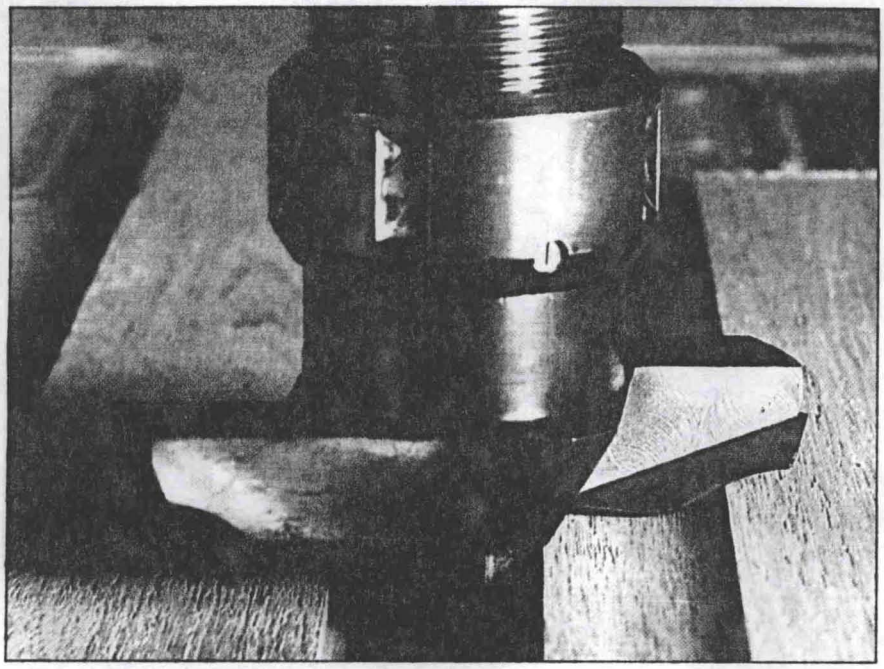


DBC50—A carbide-backed PCBN cutting tool—a variant of AMBORITE—DBC50 has been developed for the fine turning of hardened ferrous metals

SDA100+—The largest synthetic diamond grit commercially available—up to 18/20 US mesh—SDA100+ is typically used in hard rock drilling, the sawing of granite and in the construction industry

The growing market for polycrystalline blanks

Today, the main applications for polycrystalline blanks range from the large cutting tool sector, served by both PCD and PCBN blanks, through oil-well drilling, to the slightly smaller wire drawing die market segment, and finally mining applications and wear parts. The growth in demand through- ▶



SYNDITE—Available in sizes up to 68 mm in diameter, SYNDITE is used to machine a wide range of non-ferrous materials, including wood and wood-based products

◄ out the 1980s is depicted in Fig 3.

For the period 1981 to 1989, demand for PCP products when expressed in US dollars increased over 2½-fold, or 13-14% p.a. compounded annually. At the time of writing this article, volatility in the oil market sector prevented an early estimate of the polycrystalline product blanks market size in 1990.

During the nine year period depicted in Fig 3, there were two sharp down-cycles in the important PCD oil-well blanks sector, so that the overall situation is very encouraging when this is taken into account. This healthy growth is largely due to fast growing demand for PCD and PCBN blanks for cutting tool applications in the engineering and woodworking industries. Demand for these products, expressed in US dollars, grew 4-fold in these nine years for the market as a whole.

The major countries using diamond abrasive and their ranking

As a diamond manufacturer, De Beers Industrial Diamond Division concerns itself with estimating the consumption of diamond by toolmakers in each country. The toolmakers' products, however, will be sold to other countries worldwide. Therefore, the De Beers database ranks countries in terms of diamond consumption in the manufacture of grit and polycrystalline tools, and not where those tools are finally sold and used.

Note: 'Map' area scale is related to the importance of a country as a diamond tool producer

In that context, Japan is the number one consumer of industrial diamond abrasives world-wide. The USA is ranked second, followed by Germany and Italy, joint 3, the Republic of Korea fifth and Belgium sixth. These six countries accounted for over 70% of total market economy world usage in 1990 (see Fig 4).

The USSR and the P.R.C. are not shown, since hard market data are not readily available for those two countries. Both of these, however, are significantly large producers and users of industrial diamond.

The following gives an indication of the particularly large growth in consumption in Asia and the Pacific rim. Twenty years ago, diamond grit demand in Japan, Republic of Korea, India, Taiwan, Australasia and the A.S.E.A.N. countries totalled approximately 7 million carats and accounted for a little less than 20% of the 'free-world' total. Today, diamond and CBN grit usage by these countries is estimated at over 130 million carats p.a., equivalent to 35% of the total.

Conclusion

Space constraints prevent crystal ball gazing into what the 1990s hold for our industry, but we can be sure that exciting, innovative times are ahead.

In assessing the future, one may look to the past for guidance. The last 50 years have seen dramatic changes in the diamond industry, most of them occurring in the second half of that period. Our industry is no different to any other that is technology-based, in that progress may take place exponentially rather than linearly.

What can be said, though, is that we are entering the new decade with total annual sales of all types of diamond tools estimated at US$2.5 billion—$3.0 billion per annum. This vibrant manufacturing industry employs approximately 30,000 people, and the usage of diamond tools spans nearly every country of the globe.

Our industry is well placed, therefore, to continue to develop, and its geographic diversity and wide range of applications will continue to give opportunities to build bridges of understanding and friendship internationally. The changes taking place in the Soviet Union and in Eastern European countries are particularly exciting in this regard, provided a long-term view is taken ♦