

EXECUTIVE SUMMARY

0.1. ABRASIVES

- 0.1.1 One of the most widely used material removal processes for achieving high finish and high workpiece accuracy is grinding. Types of grinding processes commonly used are surface grinding, cylindrical grinding, thread grinding and billet conditioning.
- 0.1.2 In view of the high finish and high work piece accuracy achieved, several industries use grinding as an important process for manufacture. These are iron and steel industry, fabrication industries, bearing industries, auto and auto ancillary industry, machine tool industries, cutting tool industries, razor blade industries, marble and granite industry and several others.
- 0.1.3 Grinding wheels are essentially multipoint cutting tools made from various abrasives, held together in a suitable bond.
- 0.1.4 The total range of the grinding wheel production involves the usage of abrasive grains (size) from 8 grit to 1200 grit.
- 0.1.5 Bonded abrasives are manufactured as follows :
- The abrasives grains are first sized and then mixed with a suitable bond (mixing).
 - The mix is moulded to the desired shape and size and pressed to achieve the desired density.
 - The pressed product is fired in a kiln or baked in ovens at the desired temperature.
- 0.1.6 Coated abrasives are manufactured as follows:
- The abrasive grains are first sized and then dropped on an adhesive coated backing of cloth or paper. This is called a make coat.
 - The next stage is sizing. this involves a second application of adhesive to anchor the grains securely on the backing.
 - The coated abrasive is then imparted flexibility by a process called flexing. This is the controlled breaking of the continuous bonded abrasive coating.

This is followed by trimming of the edges and then cutting the sheets to required sizes.

0.2 STRUCTURE OF THE INDUSTRY

0.2.1 Bonded Abrasives

The Indian bonded abrasives has eight units in the organized sector with a total installed capacity of 13381 tonnes per annum. A large number of units exist in the unorganised sector and their capacity is 2500 tonnes. The overall capacity utilisation in the bonded abrasives industry is estimated to be about 85%. The total size of this market is estimated to be about Rs. 190 crores in value.

0.2.2 Coated Abrasives

The coated abrasives industry has six units in the organized sector with a total installed capacity of 540,000 reams per annum. The unorganised sector caters to the lower-end requirements and has a capacity of about 75,000 reams per annum. The capacity utilisation in this industry is about 60%. The total size of this market is estimated at about Rs. 110 crores by value.

0.2.3 The Major Players in the Abrasives Industry

Carborundum Universal Limited and Grindwell Norton have a range of over 20,000 different products and have a dominating presence in all the segments of the industry. These two account for 70% of the bonded and coated abrasives market, which in terms of value is estimated at about Rs. 300 crores. The other players cater predominantly to localized demand, manufacturing specific categories of products.

0.2.4 Growth

The Indian abrasives market has grown at a rate of about 2-3% in the past 5 years and is expected to grow at 8-10% annually. Growth in demand for bonded abrasives is likely to be about 12% and that in coated abrasives is likely to be about 10-12%.

0.2.5 Exports

0.2.5.1 The export of bonded abrasives & abrasive grains has increased from approximately 158 tonnes (value Rs. 63 lakh) in 1987-88 to 935 tonnes (value Rs. 6.43 crores) in 1993-94. Although this corresponds to about a five fold increase in exports, in real terms it accounts for only 2.5% of the domestic sales. The exports in the coated abrasives category has been about Rs. 3 crore in 1993-94.

- 0.2.5.2 Export have mainly been to the erstwhile USSR and have been restricted to resinoid wheels.
- 0.2.5.3 Exports in coated abrasives have been insignificant with Carborundum Universal Ltd. exporting to African countries like Tanzania and Uganda.
- 0.2.5.4 The main problems faced in respect of exports are those of price, credibility and delivery schedules. However, the industry forecasts an annual growth rate of 25% with the emphasis shifting from exporting abrasive grains to exporting value added finished products.

0.2.6 Imports

0.2.6.1 Indian manufacturers meet most of the common requirements of user industries. However, the following products are still being imported :

- Fine grit wheels of over 600 grit for finishing operations
- High speed wheels (of more than 80 rev/sec)
- Superfinishing stone.

The value of imports of bonded abrasives has increased from Rs. 3.8 crores in 87-88 to Rs. 27 crores in 1993-94 and that of coated abrasives has increased from Rs. 86.8 lakhs (in 1987-88) to Rs. 4.6 crores in 1993-94.

0.2.7 Technology Status

0.2.7.1 Technical Collaborations

Most of the manufacturers have foreign technical collaborations. The collaborators provide R&D support through product/process upgradation and manpower training. Indigenous manufacturers have been successful in bringing out internationally used products and adapting them to local needs. This has been due to a continuous dialogue between the manufacturers and the user industry. However, the initiative lies with the user industry, who with their foreign collaborators, identify new products and processes in use internationally, and then communicate this to indigenous manufacturers who react by developing them.

0.2.7.2 Manufacturing Technology

All the manufacturers feel that the plant and equipment provided

by indigenous suppliers is of satisfactory quality and is at par with international standards.

0.2.7.3 Raw Materials and Inputs

The raw materials used are abrasive grains of Aluminium Oxide, Silicon Carbide and Zirconia of grit size of 8 to 1200. Grains of grit size more than 600 are imported. Fine grains can be manufactured in house but the low volumes do not justify high investment in machinery. The conventional abrasives are also expensive compared to the internationally available products because of higher raw material and power costs.

Raw materials used in coated abrasives, that are imported, are special paper for waterproof backing, fibre and splicing agents.

0.2.7.4 Testing and Quality Control

The major grinding wheel manufacturers have good facilities for testing of raw materials used. Quality control procedures employed by the major manufacturers are also quite adequate, as regards the bonded abrasives. However, in the case of coated abrasives, the extent and features of facilities available has not been established.

0.2.7.5 R&D Efforts

The major manufacturers have well equipped in house R&D setups with the main objective of developing new products and processes aiming at cost reduction and productivity improvement.

The expenditure on in house R&D for the major players is about 2% of annual sales turnover.

None of the research institutions like IITs & CMTI are doing any research in areas related to bonded and coated abrasives, but for some work related to superabrasives at CGCRI and NPL.

0.3.0 INTERNATIONAL SCENARIO

0.3.0.1 The world market for Bonded and Coated abrasives is estimated at Rs. 4500 crores and Rs. 6000 crores respectively. The major players are Norton, Baystate and 3M from the USA, Tyrolit and Treibacher from Austria, and Noritake from Japan. Norton Co. is the world leader in abrasives and manufactures the entire range of products in bonded and coated abrasives.

- 0.3.0.2 The estimated consumption of abrasives by Eastern Europe & the erstwhile Soviet bloc is 27% of the world market, Asia 25%, North America 21%, Western Europe 17%, Latin America and Africa (5% each) and Australia (1%).

The application of grinding as a material removal process has become mature with very few niches remaining for exploitation. As such the world grinding wheel market is not expected to grow in the near future. The US market is shrinking by 1-2% every year and the shrinkage is much more in Europe. However, demand in developing countries is on the rise.

0.3.2 The Latest Developments

Abrasives manufacturers worldwide have focussed their efforts on grain development, newer and stronger adhesives for product durability and better productivity. Other developments have been in High Speed vitrified wheels of more than 150 mps and diamond & CBN wheels.

In the case of coated abrasives, the latest developments have been in non-woven abrasives and scouring pads.

0.5.0 TECHNOLOGY GAPS

0.5.1 Raw Materials

- 0.5.1.1 The quality of raw materials available in the country is not at par with international standards. Only a limited variety of raw materials are available. Premium abrasives like zirconia seeded gel, cubic boron nitride, boron carbide have to be imported. Fine grit of over 600 grit size also needs to be imported.

- 0.5.1.2 Heat treatment of grains, an important process employed by foreign manufacturers, is done for processing deficient grains by the Indian manufacturers.

- 0.5.1.3 With respect to bonding and reinforcing agents, there is no appreciable technology gap and local manufacturers have been able to meet the requirements of the industry.

0.5.2 Equipment

Although the indigenous suppliers of equipment have been reported to be able to manufacture equipment for a given design and specification; the precision, control, performance and degree of sophistication could be vastly improved. A gap exists in the level of automation existing in plants of Indian and foreign

manufacturers. This is essentially due to the high additional investment required.

0.5.3 The Product

0.5.3.1 Although technical knowhow exists for manufacturing the entire range of bonded abrasives, some products are still being imported because the production volumes for these products would be too low to justify investment in equipment to manufacture them.

0.5.3.2 In coated abrasives, the products that need further development are flexible belts, non-woven fabric abrasives, polyester backed abrasives, seeded gel abrasives and wide belts.

0.5.4 Processes

The technology gaps identified with respect to the manufacturing processes are:

0.5.4.1 Inconsistency among batches due to non-automated processes or non-conformance to process parameters.

0.5.4.2 There exists a technology gap in the availability of high tonnage presses and their accessories.

0.5.4.3 Energy consumption of refractories is very high and the efficiency of the firing system needs to be improved.

0.5.4.4 As of now, only paper packaging is being used and newer packaging materials need to be explored.

0.5.5 Testing and Quality Control

The testing facilities are considered to be inadequate. Although the major manufacturers have inhouse testing facilities for continuous quality monitoring, the products still require trials at the customer site to standardize the specifications with respect to the equipment and operational conditions. Most of the testing machines are imported.

CMTI, BHEL, IISc have very good testing facilities but they have not been used extensively.

0.6.0 CONCLUSIONS

0.6.1.1 The industry estimates a growth of about 3.5% per annum in the domestic market with a trend towards demand for high performance products. The export market offers tremendous potential

but tapping this market would mean investment on modern machinery and equipment to increase the level of automation and ensure product quality and consistency. Indian manufacturers are required to explore closely the international market, specifically for vitrified products and for labour intensive products where India is cost competitive.

- 0.6.1.2 The survey of manufacturers and users of abrasives revealed that coated abrasives were preferred due to better finishes achieved and higher productivity obtained. It was stressed that as users would benefit from using coated finishing systems, more users would switch to using coated finishing systems in the future. The demand for coated abrasives is likely to grow in the future, mainly because of the larger productivities that are possible. Hence, the development of machines and equipment suitable for coated abrasives which is currently a lacuna, should become a thrust area. Further, it was felt by a majority of the users that capital equipment which is commonly used by all abrasive manufacturers was not available easily. Hence, it is suggested that development of such equipment could be taken up on a consortium basis to benefit the industry as a whole.
- 0.6.1.3 The industry is dominated by the presence of a few major players with closely held technologies. Expertise in niche segments should be developed and the market in such areas should be exploited.
- 0.6.2 Premium abrasives like Zirconia, CBN etc. are not being manufactured in the country. Indigenous production of these grains should be taken up on a priority basis. Research work on development of these grains should be carried out at central research institutions. Some of the CSIR laboratories are engaged in work related to the development of super abrasive grains. Commercialisation of these products needs to be accorded attention.
- 0.6.3 Equipment for process control, inspection, testing and quality control do not meet international standards. Also, to bring down the cost of grinding and to introduce new, high quality products, manufacturers expressed that specialized manufacturing and QC equipment should be allowed to be imported under concessional import schemes.
- 0.6.4 To keep pace with international developments in technology, the Working Group on Perspective Plans for the Cutting Tool Industry had recommended the establishment of a cutting tool research institute. This institute should develop close interaction with the abrasive industry to identify technology gaps and also develop

links with established overseas research and academic associations to keep abreast of international developments.

0.6.5 None of the national laboratories or institutions are conducting any significant R&D work in abrasives. It is recommended the manufacturers should sponsor research projects for improving products and processes related to abrasives.

0.6.6 R&D efforts in the country should be attuned to the international research efforts in material sciences. Research tie-ups should be allowed with leading overseas manufacturers to facilitate continuous inflow of inputs on latest technological developments.

0.7.0 RECOMMENDATIONS

0.7.1 There is tremendous potential for growth in exports for most types of abrasives. Indian manufacturers are required to explore closely the international market, specifically for vitrified products and for labour intensive products where India is cost competitive.

0.7.2 Machinery and equipment used in the industry has to be modernized to replace outdated existing equipment. The level of automation has to be increased to ensure improved product quality and consistency.

0.7.3 The demand for coated abrasives is likely to grow in the future mainly because of the larger productivities that are possible. Hence, development of machines and equipment suitable for coated abrasive machining should become a thrust area.

0.7.4 It was felt by a majority of the manufacturers that capital equipment which is commonly used by all abrasive manufacturers was not available easily and it was suggested that development of such equipment could be taken up on a consortium basis to benefit the industry as a whole.

0.7.5 A majority of the manufacturers have their own testing facilities. However, a need for setting up common testing facilities was felt. Wherever testing facilities already exist, it was felt that the procedures to avail of these facilities need to be simplified and an effort made to reduce lead time required to make use of these facilities.

0.7.6 Indigenous production of premium abrasives like zirconia, CBN, should be taken up in order to improve productivity of the products.

- 0.7.7 Reasearch work on the development of these grains should be carried out at central research institutions. CGCRI was doing pioneering work on super abrasives. It is recommended that a consortium approach be adopted to develop products and processes. These products and processes would be identified by the industry (based on its requirement) and the development of these products and processes by research institutes could be coordinated/monitored by DSIR.
- 0.7.8 Premium abrasives like seeded gel are not available in the country and need to be imported. However, imports are very expensive. This has resulted in reduced usage of superabrasives. However, use of these abrasives results in high productivity and superior finishes and high quality of the final product. Hence it was felt by the industry, that the import duties on these abrasives need to be reduced.
- 0.7.9 The equipment for process control inspection, testing and quality control do not meet international requirements. Also, to bring down the cost of grinding and to bring in new, high quality products, specialized manufacturing equipment will be required. Manufacturers expressed that import of such equipment should be allowed under the concessional import scheme.
- 0.7.10 The manufacturers and users of abrasives products shared the view that technical institutes should introduce focussed courses on abrasives manufacturing and use so as to enable students to enhance their knowledge in this area and contribute positively when they enter the industry.
- 0.7.11 Inhouse R&D efforts towards import substitutions of products/ processes should be initiated.
- 0.7.12 To keep pace with international developments in technology, the Working Group on Perspective Plans for the Cutting Tool Industry had recommended the establishment of a Cutting Tool Research Institute. The Institute would develop close interaction with the abrasive industry and take up research programmes in area of identified technology gaps. The Institute would also develop links with established overseas research and academic associations and international producers to keep abreast of international developments.
- 0.7.13 The industry and research institutions should be in close contact with international trends in user industries. This would enable development of application engineering methods.

- 0.7.14 In view of the power intensiveness of abrasive grain manufacturing plants, setting up minihydel projects for captive use should be considered.
- 0.7.15 To ease the situation of shortage of power it was expressed by the manufacturers that usage of LPG for industrial applications should be made easier, by lowering of levies on LPG. Use of natural gas as a substitute for LPG could also be studied.
- 0.7.16 Good warehousing facilities abroad, reliable transportation services and better infrastructure should be provided to ensure longevity in export markets. Industry should take suitable action.