

Why India is good for doing composites business

Dr N.G. Nair of NGN Composites and Mr Y.J. Jayakumar of the FRP Institute promote the benefits of doing business with India.

A question generally asked by the international composites fraternity is 'What is the future for composites business in India?' This question often arises because of the extremely low production volume of composites in the country. A similar question was posed ten years ago when the automobile industry wanted to come to India. Today, India has become a major player in automobile field, not only selling cars within India, but also designing cars and selling them in the international market.

India offers large potential for global collaboration both in trade and technology in composites applications. It is today the fourth largest economy in the world and the second fastest growing market in Asia. India has a huge middle-class population with high purchasing capacity. This market potential has been proven in the case of automobiles (both four and two-wheelers), electronic goods and other consumer durables. As in the case of information technology (IT), India can supply trained engineers and skilled workers for all types of production-related operations from design, through to product development and manufacture.

The Indian composites industry recorded 25% growth during 2004. It is expected that production will double every 4-5 years which means that the volume could go up to at least 600 000 tonnes per year by 2020. This

requires many more glass fibre producers, resin manufacturing units, enhanced design capability, setting up many mechanised processing facilities and large increases in trained manpower. As composites become more accepted by the end-user industries, its competitiveness with steel, aluminium and timber will improve. The scarcity of timber makes composites a good wood substitute.

The Indian composites industry recorded 25% growth during 2004.

For example:

- India currently needs 40 million more houses to accommodate its population. Assuming six doors for a house, utilising 60 kg composites, 2.4 million tonnes of composites could be used for this single application. Even a fraction of this number would be very attractive for the composites industry.
- The requirement for road transport passenger buses is growing at the rate of 30% annually.
- India manufactures more than 2000 railway passenger coaches every year. Many composite items are in use in these coaches and many more applications are being promoted on a larger scale.

- Wind energy development alone requires more than 100 000 tonnes of composites for the projected potential of 45 000 MW.
- India needs 200 000 road transport tankers for carrying chemicals and water.
- Every year 2000 km of pipelines will be added for transportation of water, chemicals and gases.

All these statistics show the large size of the Indian market. It should be noted that all other advanced developments in field of bridges, marine vessels, automobiles, machine elements and others have not been considered in this data.

Global interaction

There is a definite need for interaction of India with the global composites community for the benefit of both. Whilst, the industries in the advanced countries



The front-end of this diesel locomotive for hauling passenger trains of Indian Railways was made by the vacuum infusion process.



The subcontinent of India lies in south Asia, between Pakistan, China and Nepal. In the north it is bordered by the world's highest mountain chain; in the south, the diverse landscape spans plateaus, tropical rain forests, deserts and beaches.



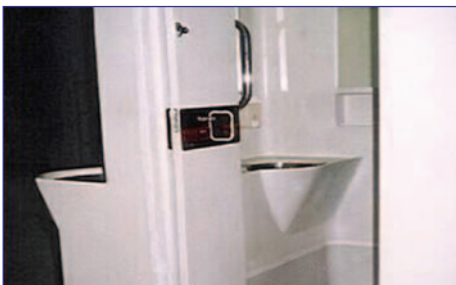
High speed patrol boat for Indian coast guards.

can promote their raw materials, process know-how and process machinery, which will benefit the Indian industry by improving its technology, production and products, the Indian industry with its technical capability and low production costs can develop export-oriented products for the international markets. This interaction could take place in three different ways.

Joint ventures

India needs an abundant supply of raw materials and speciality chemicals at affordable cost for upgrading its production capability and product quality. The opportunity therefore exists for setting up a few more glass fibre companies, several resin manufacturing units, mould making and machinery manufacturing units within the country, either through joint ventures or through technology transfer.

Foreign suppliers can open outlets in India for marketing their products,



A toilet module for passenger coaches of Indian Railways, made using the RTM process.

particularly speciality chemicals and high performance fibres and plastics. These materials must be made available, even in small quantities when needed, since it should be borne in mind that this is a 'seeding' action. The benefits and larger orders would materialise only when the manufacturer is able to use them and convince the end-user of the product developed using these newer materials.

Sales windows should be opened in India with stocks readily available. This is very important if the applications have to be developed with newer materials.

India needs an abundant supply of raw materials and speciality chemicals

Outsourcing

The production costs for making composite products can be 30-40% cheaper in India than in advanced countries in the area of hand lay-up, and at least 20% cheaper in the mechanised production processes. Industries abroad could make use of this cost advantage by outsourcing products.

Such exports of products have already taken place in the area of pipe joints, chemical process equipment and gratings which have been made by hand lay-up. Compression moulded sheet moulding compound (SMC) components, pultruded sections and filament wound pipes have also been exported. India has also shown that world class filament winding machines of up to five-axes can be developed and made available at 33-50% of international prices.

Technical services

The technical capability of Indian engineers, designers and workers in composites-related activities has been well proven. Almost all the manufacturing units in the Gulf countries and South East Asia employ Indian engineers and skilled workers. Indian researchers and academics were involved in many of the

developments in composites even in advanced countries. It is now possible to make use of this vast resource of human power for the benefit of the global industry either by outsourcing services to India or by employing them directly abroad.

A start

A good communication and operational system is required for promoting this global interaction. The FRP Institute is currently working out a scheme to promote these interactions. A beginning will be made during the next International Conference and Exhibition on Reinforced Plastics (ICERP 2006) which will be held on 23-25 February 2006 in Chennai, India. Further details of this event can be found on the website www.frpinstitute.org. Those interested in such collaborations with the Indian composites industry can contact the Institute's Business Promotion group. ■

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India's composites scene

India is the fourth largest economy in the world and the second fastest growing economy in Asia. As far as FRP is concerned, it is a huge market which is almost untapped. Dr N.G. Nair presents an overview of the Indian composites market.

India has a long tradition of using polymers and fibrous materials for making useful products. More than 4000 years ago, 'lacquer', a polymer obtained from trees grown in Kashmir, was used for making hand tools and later for making knife handles. India has abundant supply of natural fibres like jute, coir, and bamboo. Many useful articles are being made from them. Woven bamboo baskets coated with cow dung or mud were used for carrying goods and even viscous liquids. Centuries ago, when the system of nailed jointing was unknown, Indian craftsmen used to make boats, joining wooden planks by tying them together with coir rope into boat shape (called *Kettu vallam*). These boats were very popular for maritime trade between India and Africa, the Gulf countries, and South East Asia.

The very first use of fibre reinforced plastics (FRP) in India was in 1953, when a motoring enthusiast made a replica of a vintage car in North India using glass/polyester composites. However, manufacturing FRP on an industrial scale started in 1962, when Praga Industries, Coimbatore, started making roofing sheets. Helmet production was started in Chennai in 1964 by Concord Arai Pvt Ltd with Japanese know-how. During the same year, Chemical Process Equipment Pvt Ltd started making tanks for chemical industries in Mumbai using imported materials (see page 31).

Recognising the high strength and low weight of polymer composites are useful for rockets, Indian Space Research Organisation started research and development (R&D) activities in FRP at Thiruvananthapuram in 1967. India's present President, His Excellency Dr

A.P.J. Abdul Kalam, was the first head of the group which was engaged in composites R&D work.

Fibreglass Pilkington Ltd, a subsidiary of UK-based Pilkington Brothers Ltd, started making glass fibre in a plant in Mumbai, first from glass marbles/cullets in 1965, and later by the direct melt process in 1973. During the same period, Bakelite Hylam Ltd started producing polyester resins in Hyderabad. Availability of these essential raw materials triggered the setting up of several small-scale units to make FRP products.

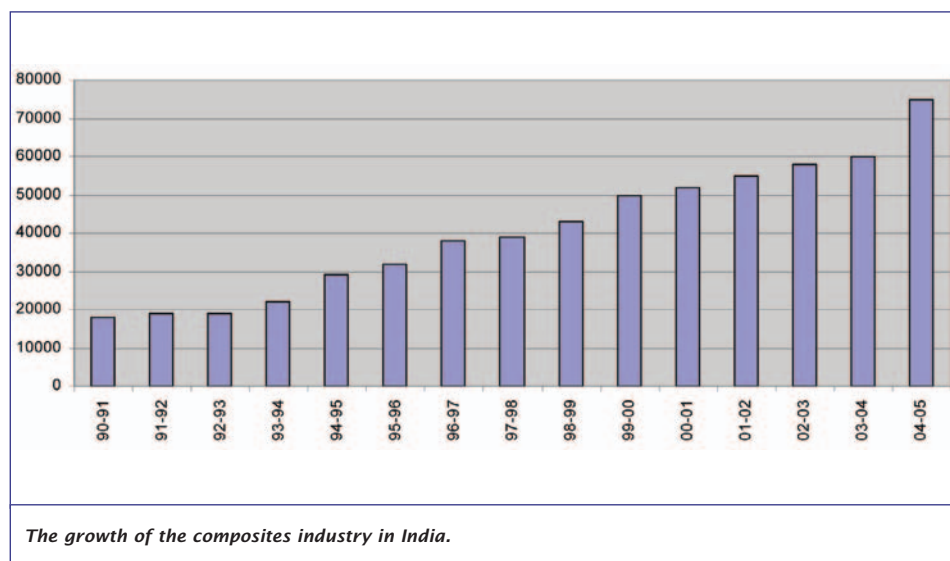
R&D activities, mainly directed towards aerospace requirements, started in early '70s, at the Indian Institute of Science and National Aerospace Laboratory, both located at Bangalore. FRP Research Centre (later renamed as Composites Technology Centre), an organised interdisciplinary centre, was established at the Indian Institute of Technology Madras, Chennai, in 1974, for teaching, academic research and

industry oriented R&D work on composites technology.

With the availability of raw materials within the country, glass fibre based composites production started growing at a steady rate. Restrictions on imports have however affected the growth of composites based on other fibres like carbon and aramid, until recently.

During these three decades, more than 1200 small scale industries have sprung up in the country. More than 98% of them use hand lay-up. Filament winding was started in 1975, compression moulding in 1978, and pultrusion in 1985.

Although there was a steady growth, the total volume production has been very low. The high cost of raw materials, lack of availability of many essential materials because of import restrictions, and the lack of mechanisation, affected the growth in volume production. As a result of its relatively high cost, FRP could not compete with steel, aluminum



or timber. Hence, growth took place in sectors where FRP had performance superiority, as in chemical process equipment and electrical insulation.

Improvements in volume growth only started from early 2000 as a result of the globalisation of the Indian economy. The industry has reacted to this change slowly, but a welcome change to more rapid growth has now come.

Aerospace

However, during the same period, the use of composites in aerospace and defence sectors showed a different picture and rapid technological developments have taken place. Extensive use of composites in applications such as rockets, satellites, missiles, light combat aircraft, advanced light helicopter and trainer air craft has shown that India is on par with the advanced countries in the development and use of composites in this area.

Present status

India has now established a good industrial base for the rapid growth of the industry. A brief outline of the achievements in various sectors is given below.

Glass fibre

India has three glass fibre manufacturers with an installed capacity of around 55 000 tonnes per annum. Several glass fibre weaving units also have been established for weaving and stitching.

There is a carbon fibre production facility at the National Aerospace Laboratory, but it is not sufficient to meet industrial needs.

Polyesters

Manufacture of polyester resins is restricted to small and medium sized companies at present, but it is likely that larger units will emerge. There are about 91 polyester resin manufacturing units with an installed capacity of about 80 000 tonnes per annum. About 30% of the polyesters produced go towards the production of buttons and about 10% for the production of filler paste. The rest of the resin is used for composites. All grades of polyester resins, excluding

Mechanised composite production facilities in India.

Type of facility	No. of units	Installed capacity (tonnes/year)
Filament winding	15	15 000
SMC manufacture	6	20 000
Pultrusion	8	10 000
Compression moulding	20	20 000
Automated grids/grating making machine	1000	
VARTM	15	30 000
FRTP* pellet making plants	10 big, 20 small	35 000+
FRTP* injection moulding	>150	n/a

*FRTP = fibre reinforced thermoplastic

some very special grades, are being made in India.

Epoxies

Epoxy production started in India as early as the 1970s, but volume production started only with the manufacture of epichlorohydrin in India. There are six major units producing epoxies and epoxy adhesives, phenolics and other thermosets. India produces limited quantities of liquid phenolics, thermoset polyurethanes and polyimides.

Thermoplastics

With very large manufacturing units, India is a major global player in the manufacture of both commodity and engineering thermoplastics. However, this has not enhanced the use of fibre filled thermoplastics. Speciality plastics like polytetrafluoroethylene (PTFE), polyimides (thermoplastics), polyether sulphone (PES) and polyetheretherketone (PEEK) are also being produced in limited quantities.

Adhesives, core materials, and speciality chemicals

This is an area where India has not progressed. Although there are units making some of these materials, their quality does not seem to be sufficient to use in durable composite products.

Composites manufacture

Composites manufacture, because of its employment potential, is reserved for the small and medium-scale sectors. As a result, India does not have large

manufacturing plants for composites manufacture as in some of the advanced countries. India has about 25 medium-scale production units with annual production ranging from US\$1-10 million. There exist well over 1200 small-scale units.

Almost 80% of the industries are still engaged in the hand moulding. The labour cost of hand lay-up production in India is only 10-15% of the total production cost, and this low production cost makes it attractive to use hand lay-up moulding.

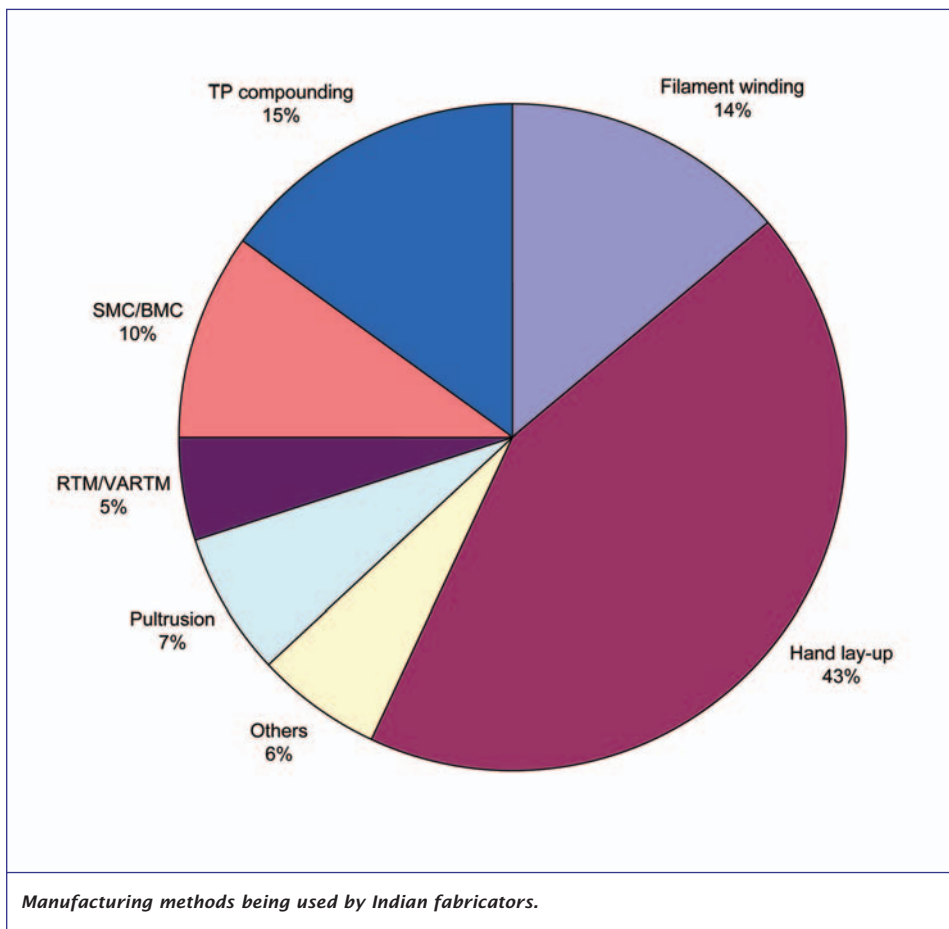
Trained manpower

Indian engineers and skilled workers are manning the composites industry in many other countries. Within India trained engineers and skilled workers are also available. Training facilities are being provided by Indian Institutes of Technology (IITs), FRP Institute and consultants like NGN Composites.

Design and R&D skills

Many of the developments in the advanced composites in USA, UK and Germany were, and are, being carried out by non-resident Indians. Back in India, R&D initiatives in composites have been made by several IITs, the Indian Institute of Science (IISc) and universities.

The national committee for science and technology constituted in the early 1970s, identified composite materials as



an important area for development. Since then the Department of Science and Technology (DST), Government of India, and the Council of Scientific and Industrial Research (CSIR) have given top priority to R&D in composites.

The Technology Information Forecasting and Assessment Council (TIFAC), a unit of DST, has an ongoing Advanced Composites Programme under which technical guidance and financial assistance in the form of soft loans are being given to industries for development of new materials, new processes and new products (see pages 28-29).

As a result of these government initiatives, there exists a good group of specialists in the country who can undertake R&D and consultancy work on composites.

Product applications

This is an area where India has excelled and shown initiative. The innovative skills of FRP manufacturers have helped

to produce a large number of products in India. The aerospace and defence sectors have designed and produced some world-class products within India with totally 'home grown' technology. India has also shown excellent product development and manufacturing capability for making products such as wind turbine blades, chemical process equipment, electrical insulation products, railway coach components, rail sleepers, roof systems and wood substitutes.

Until recently, because of the high cost of composites compared to steel, aluminum or timber, the composite industry, in spite of its innovative skills, could not grow in terms of volume production. However, with greater stability in prices, composites production has been showing an upward trend from 2003.

The total production of composites in 2004 was about 75 000 tonnes. The chart above shows the manufacturing methods being applied.

Future with promise

India is the fourth largest economy in the world and is the second fastest growing economy in Asia. So far as FRP is concerned, it is a huge marketplace almost untapped. Well trained manpower is available, making the production cost one of the lowest in the world. The beneficial effects of liberalism and globalisation of the Indian economy have yet to penetrate into the composites industry. Materials and machinery can be easily imported and export of products and service is much easier now; it is a time for the global composites industry to work with its counterparts in India for the benefits of both. Some of possible routes to collaboration are:

- Raw materials can be imported by foreign manufacturers. They can start their own outlets and later, as the demand grows, they can set up production facilities in India.
- Products can be manufactured in India, either under joint ventures or under buy-back arrangements with Indian industries.
- Infrastructure like mould making, machinery fabrication etc., can be done in India for the Asian region.
- Support services like design, prototype development, software etc, can be outsourced from India, as many multinationals are doing in the case of general engineering.
- Trained engineers and skilled workers from India can help industries all over the world.

What is needed now is global collaboration. Only when the composites industry on a global level joins together for common good, can it compete with the mighty metal industries and augment the depleting timber resources. The future is always for composites. ■

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Advanced Composites Programme: from concept to commercialisation

Sangeeta Bakshi, G. Srikanth and Soumitra Biswas outline the work of the Advanced Composites Programme of the Technology Information, Forecasting & Assessment Council (TIFAC).

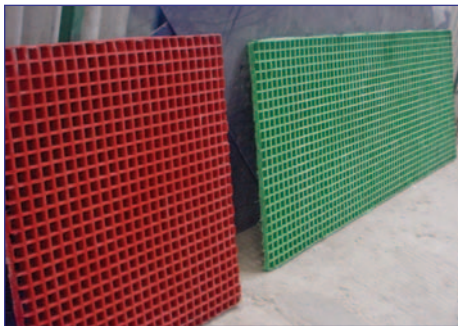
The composites technology scenario in India is fraught with two extremes. While world-class capabilities are demonstrated in the country's aerospace sector, traditional processing techniques are still being deployed in the majority of industrial applications. Other factors such as non-availability of speciality input materials, under-use of advanced fabrication techniques, and lack of application-oriented research and development (R&D) have also restricted the growth of Indian composites

industry. It is strongly felt that with the adoption of advanced technologies and some extent of standardisation, these problems could be taken care of.

There is a need to boost the usage of composites through indigenous design capability, product development and testing.

enhance the utilisation and application of composites in various sectors and to improve the laboratory-industry linkages towards development and commercialisation.

Infusion of appropriate knowledge is a major factor to facilitate development in an industry. The Advanced Composites Programme has helped SMEs in accessing the knowledge support from external agencies such as national R&D labs, academic institutes etc. Such an intervention has been instrumental behind formulating an innovative application, to fabricating the prototype. The knowledge support from the technology partners encompasses providing design support (product design for improved



Composite gratings.



Filament wound composite pressure vessel.

Assessing the status of composites industry in India, it is seen that there is an ardent need to boost the usage of composites through indigenous design capability, product development and testing. To promote the usage of composites as an improved performance material in India, the Advanced Composites Programme is being implemented at national level by the Technology Information, Forecasting & Assessment Council (TIFAC), an autonomous organisation under the Department of Science & Technology, Government of India. The Advanced Composites Programme has been an experiment to bring about a culture of technology development towards commercialisation, especially for the technology starved small and medium-sized enterprises (SMEs). The programme has been an attempt to



Composite artificial limbs.



Cabinet made of jute core board.

aesthetics and mechanical design for end-use), advice on raw materials selection, procurement of automated plant and machinery, fabrication technique, mould design, testing and certification of the product etc.

For all the projects supported by the Advanced Composites Programme, setting up of in-house testing laboratories has always been emphasised. This has generated enough confidence among the industry for the development of novel composite applications meeting international standards and quality norms.

Involvement of users in the process of development can be the cornerstone of success for a project. The Advanced Composites Programme has always inducted key experts from the user groups, certification agencies etc. in order to ensure a user-oriented and user-focused development approach. This has greatly helped reduce the product development cycle and improved the product's market reach.

Projects

The Advanced Composites Programme has to its credit 36 projects, which have been launched in active collaboration with the composites industry and knowledge support from leading research institutions in the country.

A wide array of composite products such as composite gear-case for railway locomotives, high energy efficient composite axial flow fans, jute-coir composite boards, composite modular toilets

and main doors for railway coaches, composite house-boat for tourism, composite artificial limbs, composite pressure vessels, composite grids/gratings, composite components for passenger buses, and composite acoustic enclosures have been developed successfully. Most of these products have reached the threshold of commercialisation.

The programme has made a visible impact on Indian Railways by developing nine composite products having direct relevance to the rail industry. After meeting stringent technical and safety requirements, these products have been inducted on a large-scale by the railways, thus enhancing the confidence levels in the industry as well as R&D establishments to promote commercialisation of composite technologies.

The programme has made a visible impact on Indian Railways.

A few projects were launched under the programme on natural fibre composites especially as wood substitutes for low load bearing applications such as partitions, door, panels and other interiors. Commercial exploitation of jute-coir composites for non-structural use has provided an excellent application avenue. A recent project initiative has been towards the development of bamboo composite laminates for flooring, flat panels and other similar applications. The project, expected to go full stream in 2006, would cater to international market for hard wood flooring.

Apart from providing a very effective project management and access to knowledge support, the Advanced Composites Programme has also devised an attractive technology development financing scheme for the Indian industries. The soft financial assistance is provided to the industry partner for procurement plant and machinery, raw



Modular acoustic enclosure.

material, setting up in-house testing facilities etc.

With the endeavours by the Advanced Composites Programme, composites technology, originally developed for aviation and space sectors, is now reaching the common man in a cost-effective manner and its presence is now being felt across the large geographical canvas of the country as well as diverse user segments.

The Advanced Composites Programme has proved to be the prime mover for technology innovation for Indian composites industry. The programme has very effectively demonstrated that the triad involving knowledge partner, user agencies and TIFAC as project manager can play the catalytic role for developing marketable products by the Indian composites industry. ■

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Indian company profiles

Profiles of five Indian composites organisations and their activities.

DEVI Polymers Pvt Ltd (DPPL)

DEVI POLYMERS Pvt Ltd (DPPL) is one of the pioneering polyester moulding compounders in India. The company commenced operations in 1975, manufacturing sheet moulding compounds (SMC) and dough moulding compounds (DMC). In 1978 DPPL started making compression moulded articles using SMC/DMC. From this early beginning, the company has grown today as the biggest producer of SMC/DMC with annual production of 4000 tonnes.

DPPL initially started producing SMC components for electrical switch gear companies (low tension sector). It is now one of the leading original equipment manufacturer (OEM) suppliers in the switch gear sector, supplying almost all switch gear manufacturing companies in India, including Larsen & Toubro (L&T), Siemens India, GE India, Legrand, Havels, and HPL Socomec. Some of them buy SMC for their in-house production.

Devi Polymers is a family-run business. Its current turnover is US\$12 million of which exports account for about 10%. There is rapid increase in the export area and this is very likely to reach 30-40% in the next five years.

Facilities

DPPL has three manufacturing facilities in Chennai, all ISO 9001-2000 certified. To meet global requirements, DPPL created its own in-house facilities for manufacturing dies and tools. There are also around 30 hydraulic presses ranging from 50 tonnes to 1000 tonnes capacity for moulding various SMC/DMC components. DPPL has excellent testing

facilities for testing physical, mechanical and electrical properties of SMC/DMC raw materials. It also has a well integrated design facility enabling it to support customers to design the product from the conceptual level. It provides services in product design as well as tool design.

DPPL has developed under one roof integrated facilities for design, development, manufacture and testing of SMC/DMC compounds, including mould manufacturing. The hydraulic presses subsequently ordered have also undergone design changes based on the expertise gained by DPPL over the years.

Products

Although a compounder, DPPL has developed many products and marketed them both in India and abroad. Initially electrical insulation products were made and marketed. During late '80s a major effort was made to develop and introduce sectional water tanks, modular equipment enclosures and moulded electrical enclosures. All these products are now being exported to Gulf countries, the USA and UK.

Water storage tanks

One of DPPL's main products are sectional panel water tanks made of SMC. SMC/GRP panels of 1 m x 1 m, 1 m x 1.5 m (high) and 1 m x 2 m are assembled to make tanks with capacities ranging from 1000 litres to 1 million litres or more.

The design enables these tanks to be reinforced externally with steel members and thus totally avoid any steel getting

in contact with stored water. DPPL's tanks are approved by Water Research Council (WRC), UK. These tanks are also being made as per IS-14399 and Singapore Standard SS-245.

DPPL's SMC grade raw materials are approved by Underwriters Laboratory (UL), USA.

Enclosures

DPPL manufactures 11 standard sizes of glass fibre reinforced polyester (GRP/SMC) enclosures, from 120 x 122 x 90 mm to 600 x 420 x 210 mm, to meet global requirements. These SMC enclosures are moulded using an in-house SMC grade (597/20 & 8595/30) which has approval by Underwriter's Laboratory, USA, for outdoor weathering requirements and as well as meeting flame-retardant requirements of self-extinguishing (UL-94 V-0 & 5VA). These SMC enclosures have very high protection against water and dust, as high as IP 67. The enclosures have a tongue and groove arrangement with PU gasket sealing. ■

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Chemical Process Equipment Pvt Ltd

CHEMICAL PROCESS Equipment Pvt Ltd (CPE) started operations in 1964 in a small way by the present chairman and managing director Mr B.S. Rajpurhit, but has grown to be a diversified multi-product company with a leadership in the field of fibre reinforced plastics (FRP) fabrication, with manufacturing facilities in Mumbai, Vadodara, and New Mumbai. It now has over 450 employees. It is a family-run business with a current turnover of around US\$8.5-9.5 million.

Activities

CPE designs, manufactures and erects field storage tanks, agitators, reaction



Gas cleaning plant.

vessels, pressure vessels, wet gas electrostatic precipitators, scrubbing systems, exhaust systems, polymer concrete cells, process piping, gratings, and cable trays. All products are custom-made, conforming to international standards.

The company has facilities for manufacturing high quality chemical equipment both by hand-lay up and filament winding. Process equipment is made using various thermoset resin systems, with or without a thermoplastic lining.

Exports

Equipment and piping made by CPE are in use worldwide in countries like Chile,



CPE equipment going to Chile.

Germany, USA, Finland, Kuwait, Jordan, Bahrain, Malaysia, Taiwan, Indonesia, Singapore, Thailand, Australia, Spain Italy, Saudi Arabia, and Egypt. More than 140 wet gas precipitators have been exported to various countries. CPE is one of the largest manufacturers of wet gas ESPs in the world.

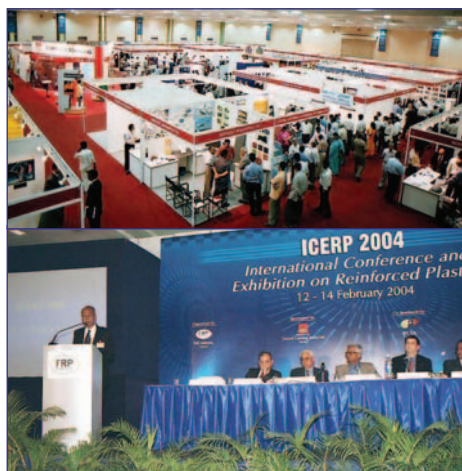
Awards

CPE has received a Top Exporter Award from the Plastics Export Promotion Council (PLEXCONCIL), Ministry of Commerce, Government of India, for 10 years. Because of the quality of products being made, CPE has also received the IMC Ramakrishna Bajaj Award 2002, certificate of merit. ■

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FRP Institute

THE FRP Institute is a non-profit making, registered society of the Indian composites fraternity. It was established in 1999 and has an all-Indian membership consisting of scientists, composite



ICERP 2004.

specialists, fabricators, raw material suppliers, consultants, designers, defence laboratories, educational institutions etc. The Institute works in close collaboration with industry and institutions to improve India's composites technology and to promote the growth of the Indian composites industry.

The FRP Institute has the following three main objectives for the composites industry:

- education and training;
- technology and quality; and
- growth and exports.

The FRP Institute is trying to serve as a facilitator to promote the rapid growth of the industry. It conducts training programmes, seminars, conferences and has also developed Voluntary Codes of Practice. To promote global interaction, the Institute has organised two

International Conferences and Exhibitions on Composites (ICERP 2002 and 2004) which have yielded excellent results. Encouraged by these it is planning to double the exhibition area of ICERP 2006 (23-25 February 2006, Chennai, India).

The FRP Institute has drawn up comprehensive development plans and if followed, the Indian composites industry could be doubling its output every five years. ■

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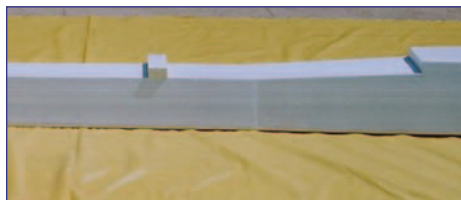
Valeth HighTech Composites (P) Ltd

THE COMPANY was established in 1990, as a licensee of Indian Space Research Organisation (ISRO) for the manufacture of ISROSIL (High Silica Fabrics). In 1992, it diversified into manufacturing advanced engineering and composite products of glass fibres, high silica, and carbon etc. The company is continuously engaged in developing and manufacturing high-tech composites and other products mainly for aerospace and defense and other industrial applications.

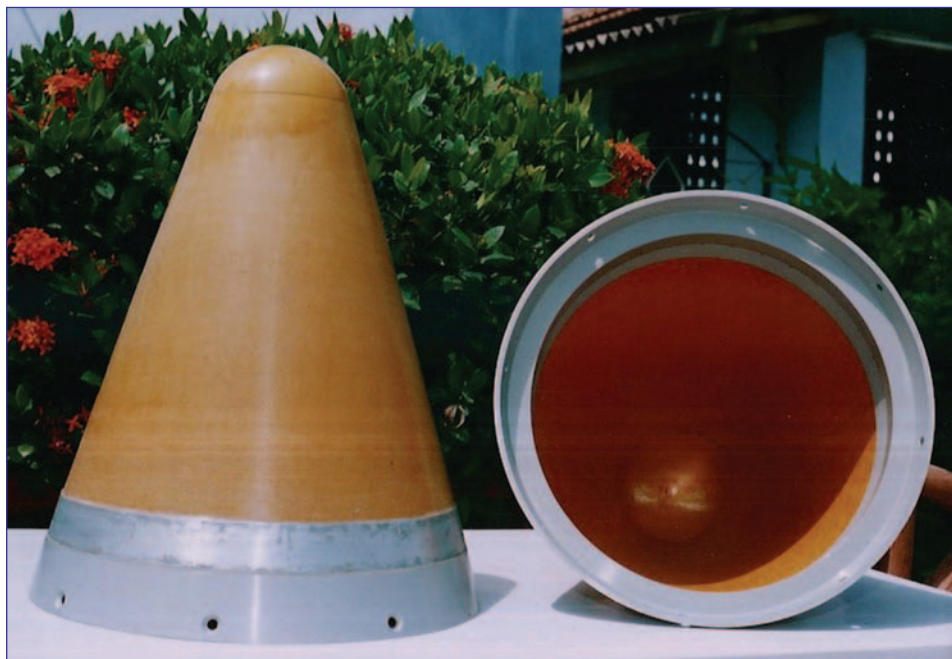
Valeth HighTech Composites is an ISO 9001:2000 certified company with an annual turnover of US\$2 million.

Facilities

A most modern factory with a built area of well over 2000 m² is situated near



Bridge girders.



Composite radomes.

Chennai, South India. The following facilities are currently available at this manufacturing unit:

- autoclave moulding;
- CNC filament winding;
- resin transfer moulding;
- resin impregnation plant;
- composite machining;
- glass fibre twisting, doubling and weaving;
- high silica textile processing;
- fabrication of high temperature textile products;
- fabrication of special purpose equipment;
- well-equipped facility for product design;
- advanced testing facilities.

Products

The company is constantly engaged in the design and development of new products for high-end technology. Some of the products developed and supplied by the company are listed below:

- Isrosil - high silica products of continuous amorphous silica filaments;

- silica phenolic lining in rocket motor tubes;
- nozzle assemblies and radomes for rockets;
- carbon composite propeller shaft for small ships;
- GRP body assemblies for defence purposes;
- flexible glass fibre air hoses for defence helicopters;
- composites shell assemblies and fittings for deep sea probes;
- carbon composite inserts/structures for satellite applications;
- composite inserts for solar panels;
- FRP sleepers for Indian Railways;
- FRP tip vanes for wind turbines;
- pressure vessels and membrane housings for reverse osmosis water treatment systems.

Developmental activities

The company is currently engaged in the development of two innovative applications of composites in the country:

- all-composite two-seater aircraft;
- all-composite high-speed planing boat with a top speed of 45 knots.

Exports

The company has all the capability to take up supply of advanced composite products for high-end applications including aerospace marine and transport systems. It can also take up and execute turnkey projects for setting up industry oriented production units for filament wound water treatment systems, compressed natural gas (CNG) cylinders, aircraft components and pressure vessels. ■

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Uniglass India Pvt Ltd

UNIGLASS INDUSTRIES Pvt Ltd (UIPL) was established in 1972, initially to carry out lining of lead acid battery storage tanks and chemical process vessels. Work on electrical insulation products started in the late '70s. The company forayed into products for structural and infra-structural applications in 1995. It is today the largest supplier of pultruded, compression moulded and filament wound electrical insulation products in India with an annual production capacity of 800 tonnes.

Facilities

The main facilities of UIPL include six filament winding machines, 10 pultrusion machines, a 250 tonnes capacity laminating hydraulic press, machine shops, tool rooms, testing laboratory etc.

Products

The company makes filament wound cylinders, compression moulded

laminates and pultruded rods and profiles. The following are the application areas for which these products are being used.

Glass-epoxy filament wound cylinders

Lightning arresters, rupturing chambers, arc pots for switchgears, OLTC tanks and hollow shafts, selector columns, switch pillars, centering tubes for tap-changers, fuse bodies for low and medium voltages, insulating rods and operating rods, insulating tubes for transformers, end rings/end blocks and coil formers.

Glass-epoxy and glass-polyester laminates

Terminal boards, stepped blocks, core support blocks and yoke insulation for transformers, rectifier boards for motors, barriers for circuit breakers, shutters for switchgears, seal off bushing for isolated phase bus ducts, motor and propeller

shaft housing for recreational boats, storage tanks and pressure vessels for chemical applications.

Glass-epoxy and glass-polyester pultruded rods and profiles

Studs for lightning arresters, selector bars for tap changers, 'T' sections and rods for gratings, 'C' channels and 'L' angles for cable ladders/trays, drive links, switching bars, tension plates for switch gears, rods for composite insulators, duct strips, dovetail strips and spacers, dog bone profiles, 'U' profiles, and hat profiles for oil cooled and dry type transformers. ■

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