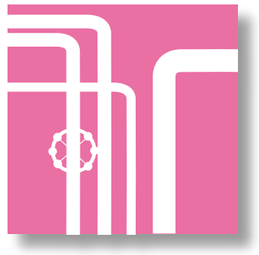
Pipes

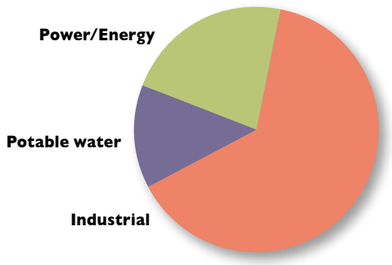
OCV™ Reinforcements | OCV™ Technical Fabrics | OCV™ Non-Woven Technologies

PIPE MARKET

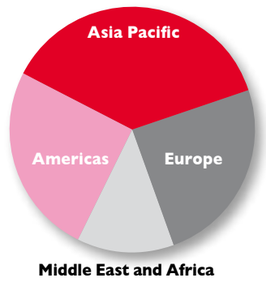


Pipes are used to carry potable water, sewage water, oil, gas, and other chemicals. It is a growing market, especially in Eastern Europe and the Middle East because of population increases and urbanization. Concrete, cast iron, steel and thermoplastic are the most common materials currently used to make pipes. However, Glass Reinforced Plastic is growing rapidly in its market share. GRP pipes can be made by Centrifugal Casting, Filament Winding and Continuous Filament Winding processes.

GLOBAL PIPE MARKET BY END USE APPLICATION (vol.)



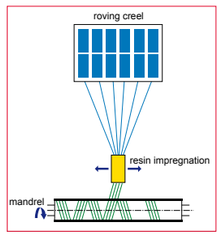
GLOBAL PIPE MARKET BY REGION (vol.)



PIPE MAKING PROCESSES

FILAMENT WINDING

There are two basic methods of filament winding. In one method, helical winding, the resin-impregnated continuous fibre rovings are wound at a controlled helix angle in each selected direction on a removable mandrel.



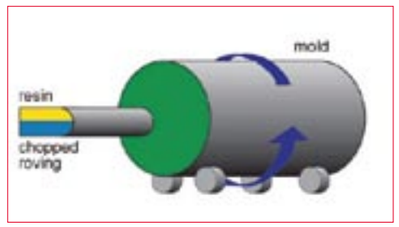
The other method, continuous filament winding, allows one to produce continuous pipes with adjustable diameters from DN80 to DN4000 with chopped fibers, circumferential wrapped fibers and sand to provide the required pipe strength and stiffness.

Most pipes made by either of the two methods have an inner layer consisting of a smooth resin-rich surface reinforced with veil made of glass to provide maximum abrasion, corrosion resistance and smoothness to guarantee lower head losses than traditional materials.

CENTRIFUGAL CASTING

Multi-End rovings going through a chopper and resin are sprayed into a rotating, cylindrical, metal mold. The resin impregnates the reinforcement under the effect of the centrifugal force and forms, after polymerization, a cylindrical structure.

Centrifugal casting is particularly well suited for producing structures with large diameters.



MARKET NEEDS

- Reliable and fast processing
- Cost-effective performance
  - Work pressure resistance vs. thickness
  - Material savings
  - Smoother exterior finish
  - Enhanced long-term durability
  - Very good corrosion resistance in acidic environments
  - Very good stress-corrosion resistance under constant stress
- Leads to easy to install/transport products
- Enables production of pipes, fittings and accessories

OCV™ SOLUTIONS

- Advantex® glass
- SE (Single-End) rovings
  ME (Multi-End) rovings
- ECR and C-Glass Specialty Non-Wovens
- Technical Fabrics; Multiaxials for pipe relining and maintenance
- CSM (Chopped Strand Mat)
- High Performance Reinforcements
- Global product portfolio for the production of pipes, fittings and accessories
- Products optimized for various resins and production processes

OCV™ BUSINESSES PROVIDE A COMPREHENSIVE RANGE OF REINFORCEMENT PRODUCTS FOR PULTRUSION

SINGLE-END ROVINGS

Our Advantex® glass SE rovings contribute to superior mechanical properties for pipes made with a continuous process. They enhance pipe life-time in chemical and sewage pipe marets.

NA	LA	EMEA	AP	PRODUCT	RESIN COMPATIBILITY ● means primary compatible resin			
					EPOXY	POLYESTER	VINYLESTER	PHENOLIC
●	●		●	158B	●			
●	●	●	●	**R25H***	○	●	●	
●	●	●	●	**SE1200***	○	●	○	○
●				366	○	●	●	
●			●	SE2348	●			
●	●		●	SE2350	●			○
	●			**688***		●	○	
	●	●	●	SE1500	●			
	●			64Y	●			
		●		117A	○	○	○	
		●		202	●	○	○	
●				346	●			

NA : North America. LA : Latin America. EMEA : Europe Middle East Africa. AP : Asia Pacific

MULTI-END ROVINGS

Multi-End rovings help easy processing and provides high mechanical properties before and after ageing. They are compatible with a wide range of resin systems such as polyester and vinylester for highly demanding applications such as pipes or tanks for wastewater treatment and chemical outlets.

** Several OCV™ Reinforcements SE and ME rovings are also safe for use in pipes for potable water distribution.*

APPLICATION	AMERICAS	EUROPE	ASIA
Centrifugal Casting		**P219***	CCR520 **P219***
Chop and Drop	P246 **495EP***	P246 **495EP***	P246 - ME3023 **495EP***

NON-WOVEN PRODUCTS

OCV™ Non-Woven Technologies provides a wide variety of ECR and C-glass veils for filament winding. The mandrel can be covered with a veil for an inner/exterior corrosion resistant and/or aesthetic surface.

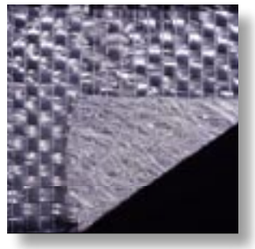
M524 RANGE	STYRENE SOLUBILITY	FIBRE TYPE	FIBRE DIAMETER	FILAMENT WINDING POLYESTER	FILAMENT WINDING EPOXY
ECR50S - ECR30S	v. sol	ECR	13	●	
ECR20A- ECR25A - ECR30A	slowly sol	ECR	13	●	
ECR70A/3 - ECR50A/3	slowly sol	ECR	13		●
ERC50H/3 - ECR30H/3	slowly sol	ECR	13		●
C64	v. sol	C	12.5	●	
C33	slowly sol	C	12.5	●	

We have in house capability to slit our C- and E-CR-glass Veils in widths of 35 mm bandages upwards.

■ **E-CR-glass veils:**
Advantex® glass wet use veils provide excellent corrosion resistance.
20 up to 70 g/m^2 veil types are suitable for both continuous and discontinuous filament winding, glass reinforced plastic and glass reinforced epoxy pipes.

■ **C-glass veils:**
Long fibre highly drapable dry use veils with excellent wet out capability and conformability.
Ideally suited for the fixture and fitting market where a resin rich surface is required to protect the outside of the pipe from Ultra Violet and chemical attack.

TECHNICAL FABRICS



Several products can be used for these applications, mainly for reinforcing the GRP pipes in order to improve the pressure resistance or for the fitting joints.

Product types

■ **Woven :** Balanced/Unbalanced Woven Roving, Tapes and UD Tapes (0° or 90°)

■ **Stitched:** Multiaxials, Unidirectionals, Woven Roving with Chopped Strand Mats

ADVANTAGES OF GRP(1) PIPES VS. TRADITIONAL MATERIALS

■ Light weight (approximately 1/10 of concrete pipes and 1/4 of steel pipes)
» lower transportation and installation costs

■ Workability of the material on site with the use of simple tools
» easy assembly and installation

■ Longer pipes than with competing materials; no welding needed and fewer joints
» lower cost and easier installation

■ Virtually impermeable
» superior leak resistance

■ Smoothness of the internal wall, minimized pressure drops and no formation of deposits
» higher transport rate

■ Better hydraulic performance than steel, ductile iron and concrete
» more efficient carrier

■ Corrosion resistance. No protection such as coating, painting or cathode are needed
» lower cost and better maintenance

■ With Advantex® glass, even more resistance to corrosion by strong diluted acids such as H2SO4, compared to E-glass

■ Better stress- and strain-corrosion resistance (to acids) than traditional E-glass reinforced GRP pipes
» "Install it and forget it"

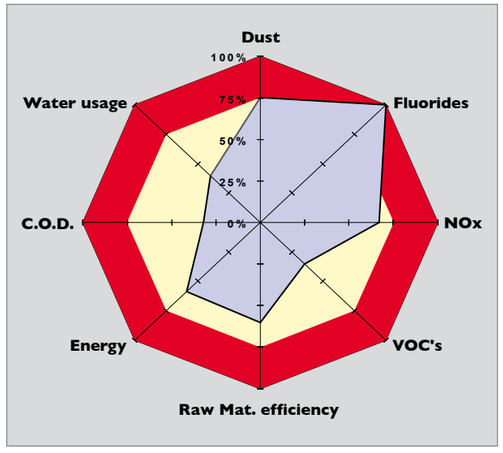
■ Low thermal conductivity
» reduces condensation problems and resulting moisture related corrosion

■ Hazen Williams flow coefficient is 150, due to low friction losses
» less pumping energy is required compared to steel and concrete pipes or the same flow rates can be ensured using smaller diameters

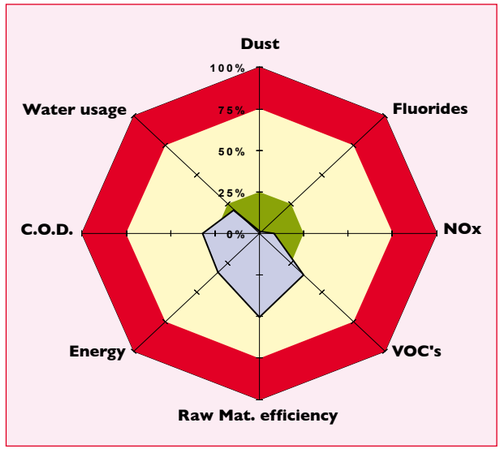
(1) Glass Reinforced Plastic

ADVANTEX® IS THE MOST ENVIRONMENTALLY FRIENDLY E-GLASS

Boron Traditional E-glass



Boron-free Advantex® glass



The above comparison was typical for OCV™ plant conversions. Actual results vary from plant to plant.

High | Medium | Low | Environmental Footprint

OCV™ BUSINESSES PRODUCE ADVANTEX® GLASS

■ **With Lower Environmental Footprint:**
. a boron-free glass
. a fluorine-free glass

■ Both a true E-glass and a true E-CR glass (according to ASTM D578)

■ Performing better than traditional E-glass particularly in acids and water and to a certain extent in alkaline solutions

■ Allowing material savings versus E-glass

■ With a superior resistance to high temperature (higher softening-point temperature)

- Up to **54% higher** allowable strain in strain-corrosion resistance, in H2SO4

- Up to **50 Years** instead of 3 months lifetime for pultruded rods, in stress-corrosion in salt water (under identical conditions)

- Up to **50 Years** instead of 4 day lifetime for rods, in stress-corrosion in1N HCl (under identical conditions)

YOUR GLOBAL PARTNER FOR COMPOSITE SOLUTIONS

OCV™ Reinforcements

OCV™ Technical Fabrics

OCV™ Non-Woven Technologies

- Facilities in 15 countries worldwide
- More than 9,000 employees
- More than 15 languages
- 39% of Owens Corning revenue
- www.owenscorning.com/composites

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Pub. N° 10010847. Printed in France. March 2009.

PIPE_OCV Range_ww_03-2009_Rev0

Conception - Réalisation : QUALIgraph - Photo credits: front cover: Amiantit (Saudi Arabia) - P6: Johnston Pipes (UK) - Amiantit (Saudi Arabia) - P7 Potok-M LLC (Russia) - Amitech (Brazil)