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RETRACKING

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ZAG

Products and Waste of Fibre Reinforced Plastics

Catalogo dei rifiuti dell'area di programma /
Katalog odpadkov programskega območja



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Slovenian National Building and Civil Engineering Institute

ZAG

- Public research institute;
- 200 employees;
- 5 departments: Materials, Building Physics, Construction, Road Infrastructure, Metrology;
- annual turnover: app. 8-10 mio €



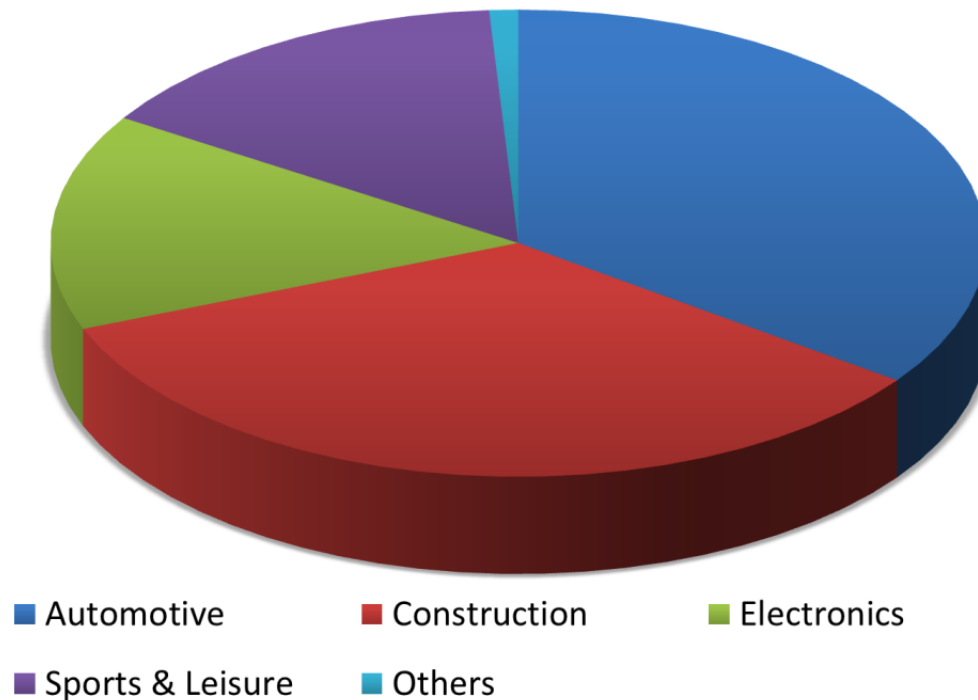
Main activities:

- fundamental and applied research,
- development of new methods of testing and measurement,
- certification and attestation (products, materials and executed works),
- training of research and technical staff,
- participation in the preparation of technical codes and standards.



Glass Fiber Reinforced Plastics (GFRP) Market Segmentation

The fiber reinforced plastics are most commonly exploited in automotive, construction, electronics and sport industries (1).



1. *Composites Market Size, Share & Trends Analysis Report By Product (Carbon, Glass), By Resin (Thermosetting, Thermoplastic), By Manufacturing Process, By Application, By End Use, And Segment Forecasts, 2018 - 2024*



Glass Fiber Reinforced Plastics (GFRP) Composites Market Facts

- Current EU (2015) market consumption of glass fibres for composite industry is estimated to be about 1100 M tons (3).
- Germany is the largest producer of GFRP, followed by Eastern Europe, France, Ireland and the UK, Italy, Portugal and Spain (3).
- The number of composite patents more than doubled in period between 2001 and 2013 when patent count exceeded 3000 (1).
- To 2024, it is projected a global composite market size growth at annual rate of 7,8 % (2).

2. A.P. Chatzimichali and K. D. Potter.; *Transl. Mater. Res.* (2) 026001 (2015).

3. <https://www.statista.com/> accessed 17.09.2018)

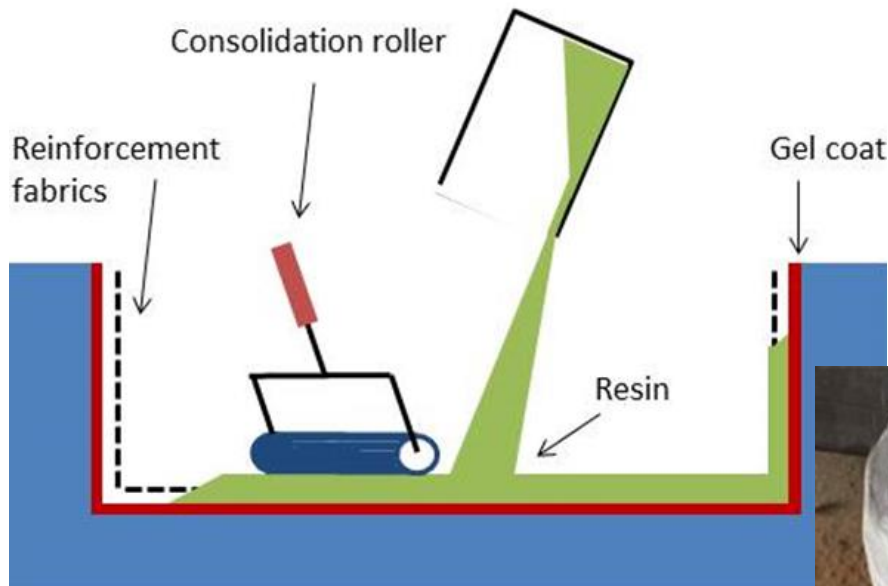


Forming processes of FRP products

- Hand lay-up
- Chopper gun lay-up
- Poltrusion
- Vacuum bag moulding
- Autoclave moulding
- Filament winding



Manual forming processes of FRP products



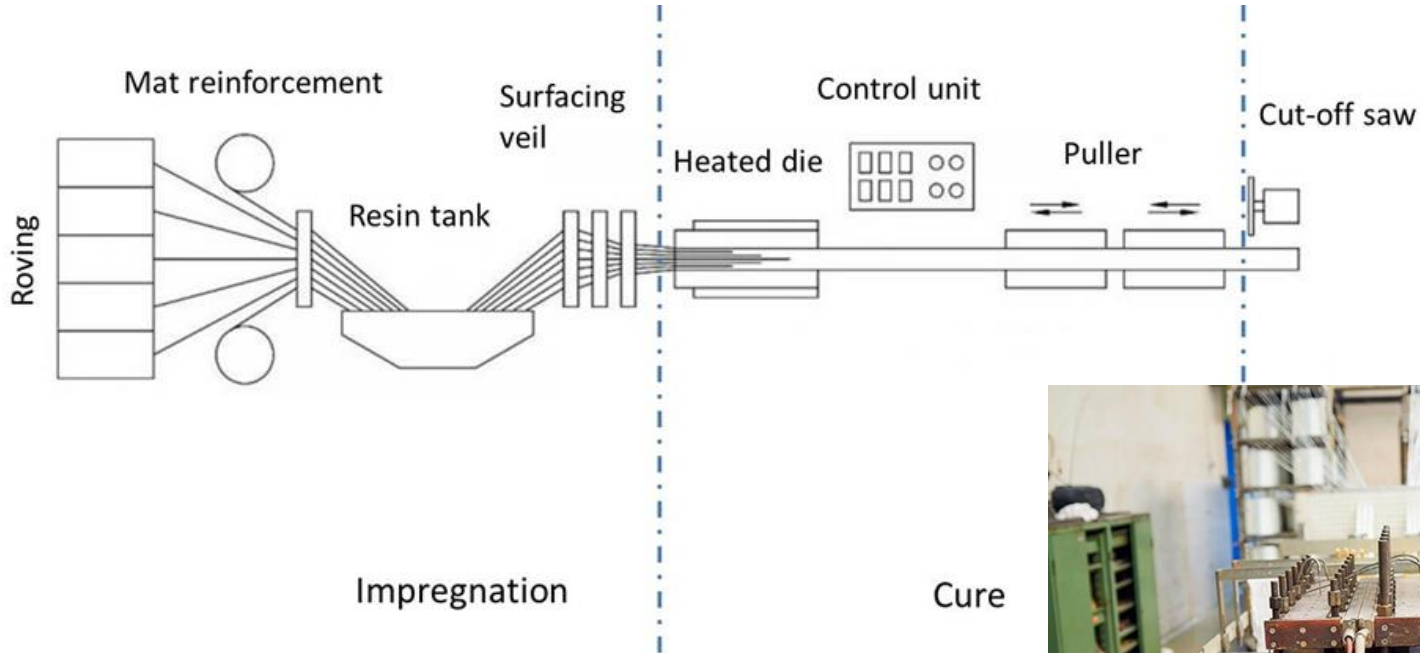
A scheme of Hand lay-up process.



The lay-up of the reinforcing fibres / resin mixture with the chopper gun.



Continuous forming process of FRP products



Scheme of the poltrusion forming process.



The photo of the finished GFRP rods at the end of the poltrusion process.



Batch forming processes of FRP products



Preparation of simple FRP plate by vacuum bag moulding.



An example of autoclave moulding setup.



Identification of GFRP waste

- Advanced methods:
 - Infrared Spectroscopy (FTIR),
 - Raman Spectroscopy,
 - UV-vis spectroscopy,
 - Differential Scanning Calorimetry (DSC)
- Specific characteristics:
 - Substantial density 1.8 g/cm^3
 - Matte surface pattern
 - Characteristic translucency



FRP waste classification methodology

- FRP based waste is classified in accordance with the List of Waste (as established by *Decision 2000/532/EC* and amended by *Decision 2014/955/EU*)
- FRP waste is found amongst different sets of chapters in accordance with source and type.
- Multiple waste entries are suggested for some waste types.



FRP waste catalogue

Number, Product/waste source	Waste code ¹	Description of waste
07 WASTES FROM ORGANIC CHEMICAL PROCESSES		
Glass fiber mat from molding	07 02 13	Waste plastic
12 WASTES FROM SHAPING AND PHYSICAL AND MECHANICAL SURFACE TREATMENT OF METALS AND PLASTIC		
FRP plastics shavings and turnings from production and other processes	12 01 05	Plastics shavings and turnings
15 WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED		
FRP pallets, used for packaging and transportation of different products	15 01 05	Composite packaging
16 WASTES NOT OTHERWISE SPECIFIED IN THE LIST		
End of life vessels, boats, planes, cars, motorcycles, caravans, and similar	16 01 04* 16 01 06	End-of-life vehicles or End-of-life vehicles, containing neither liquids nor other hazardous components



FRP waste catalogue



FRP waste catalogue

17 CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)		
Different types of pipes	17 02 03 17 02 04*	<p>Plastic</p> <p>Glass, plastic and wood containing or contaminated with hazardous substances</p>
Different types of worn out water reservoirs, including waste water reservoirs, water treatment reservoirs, sewage reservoirs etc.		
Storage tanks for different types of liquids		
Freezer chain components		
FRP roofing and fencing, FRP sandwich panels		
Flooring panels made of FRP, usually used for exterior		
FRP reinforcement for concrete, used instead of steel reinforcements		
FRP carriers, supporters for raised and suspended floors/ceilings.		
Sewage /pavement gratings and other similar products		
Traffic signs and equipment for signalization		



FRP waste catalogue



FRC Based Waste Catalogue

19 WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE		
Waste from recycling process that cannot be used in further processing	19 12 04	Plastic and rubber
20 MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS		
Sport equipment e.g. obsolete skis, tennis rackets	20 03 07	Bulky waste
Car trunks	20 01 39	Plastics
	20 03 07	Bulky waste
Slides and other equipment for children and sport playgrounds, water slides	20 03 07	Bulky waste
	20 01 39	Plastics
	17 02 03	Construction and demolition wastes - plastic
	17 02 04*	Construction and demolition - glass, plastic and wood containing or contaminated with hazardous substances
Swimming pools and other equipment	20 03 07	Bulky waste
	20 01 39	Plastics
	17 02 03	Construction and demolition wastes - plastic
	17 02 04*	Construction and demolition - glass, plastic and wood containing or contaminated with hazardous substances



FRP waste catalogue

20 MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS		
FRP hoses for irrigation and other obsolete irrigation products	20 01 39	Plastics
	20 03 07	Bulky waste
Tanks, vats and similar equipment used in different agricultural fields and households	20 01 39	Plastics
	20 03 07	Bulky waste
Bathroom and kitchen sinks, baths and other similar products	20 03 07	Bulky waste
	17 02 03	Construction and demolition waste - plastic
	17 02 04*	Construction and demolition - glass, plastic and wood containing or contaminated with hazardous substances



FRP waste catalogue





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Project partners



Polo Tecnologico di Pordenone (IT)



Gees Recycling (IT)



Zavod za gradbeništvo Slovenije (SLO)



Infordata Sistemi Srl (IT)



Gospodarska zbornica Slovenije (SLO)

