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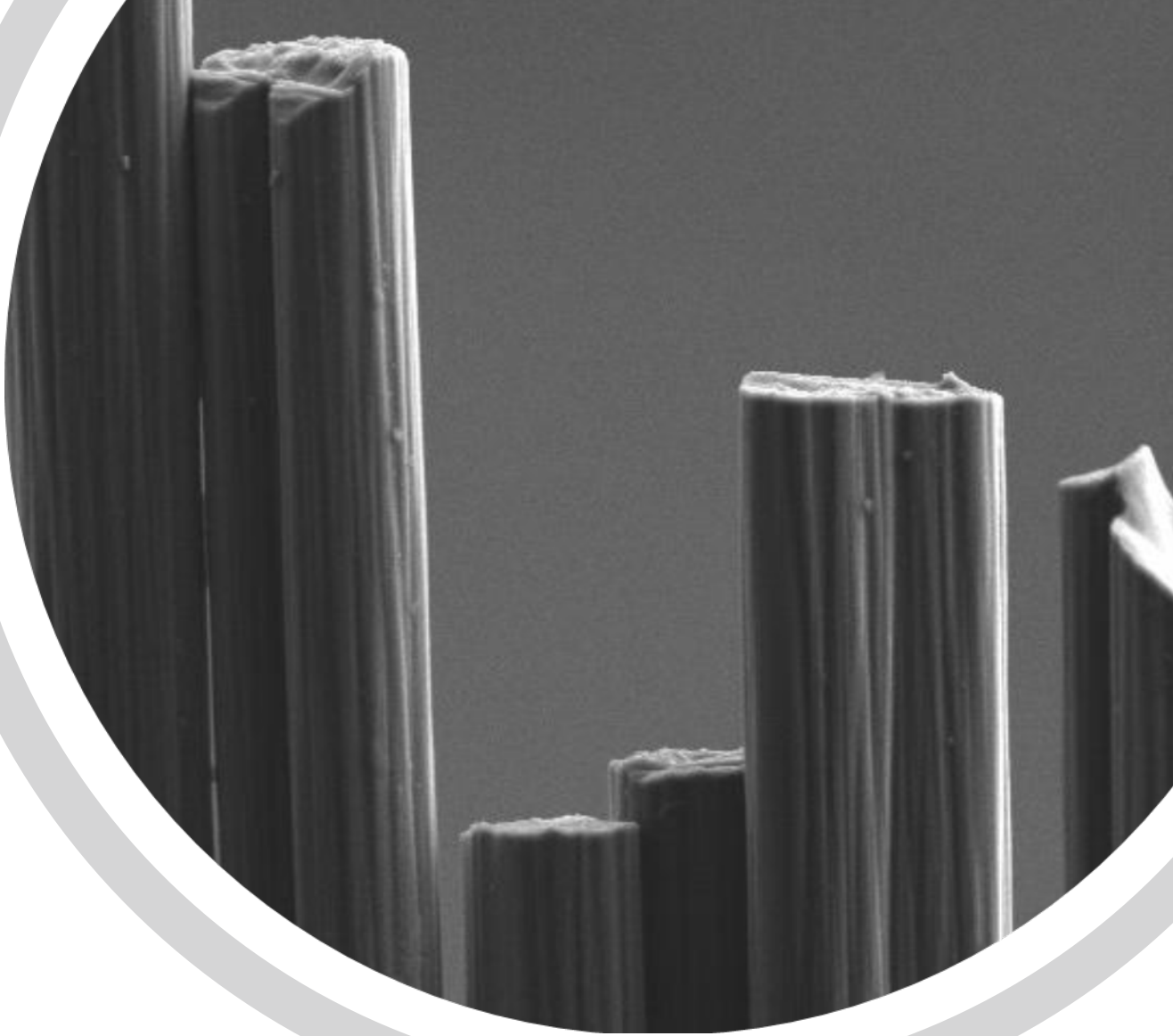
Circular Economy for the Carbon Fiber Industry

EcoCarbonio



Partner: Persico Marine SRL.
Start of Project: 02/01/2020
End of Project: 30/11/2022
Project Budget €5.7m

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Persico Group is a private, family-run company that has been in business for 40 years. It boasts a turnover of more than €175 million and can leverage consolidated expertise in the automotive, high-performance nautical and advanced manufacturing technology sectors.

The headquarters of the group are located in Nembro (Bergamo), with other manufacturing plants in Italy. The group also has production and sales facilities in Germany, the United States, Mexico and China, to serve its clients around the world.

Thanks to its solid financial footing, the group can invest heavily in R&D with a view to developing new technologies and materials, and can guarantee the completion of each project to the highest levels of quality within the agreed timeframes.

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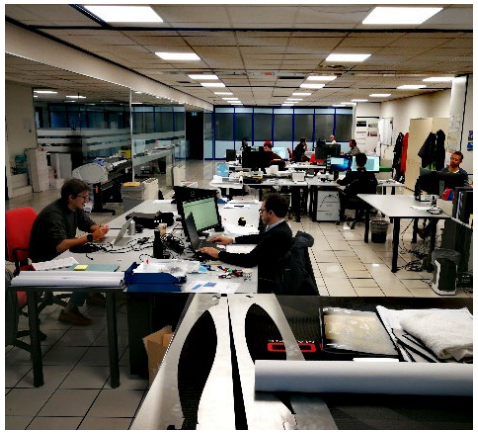
IDENTITY

Reliable performance



Skills matter

Importance of tools

Investing in the future

Racing heritage

Unparalleled experience

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SUSTAINABILITY

- Hydroelectric power plants
- Solar panels
- Supplier for the recycling of carbon fiber

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ACTIVITIES

Having analyzed the properties of the EcoCarbonio fabric produced during the course of the project, Persico has geared its experimentation towards the design and manufacture of non-structural components, created through the impregnation of the fabric with epoxy resins by means of infusion.

Sink

Candlestick holder

Omega plinth

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CRITICAL ISSUES IN PROCESSING

- Control of the quantity of material
- Control of the thicknesses of the component
- Complicated manoeuvrability during processing

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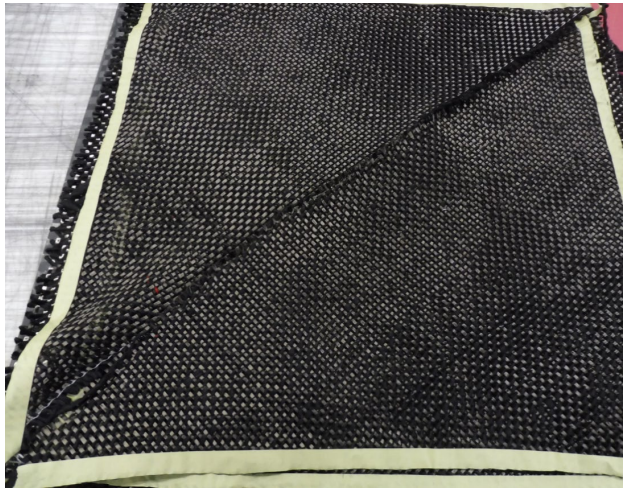
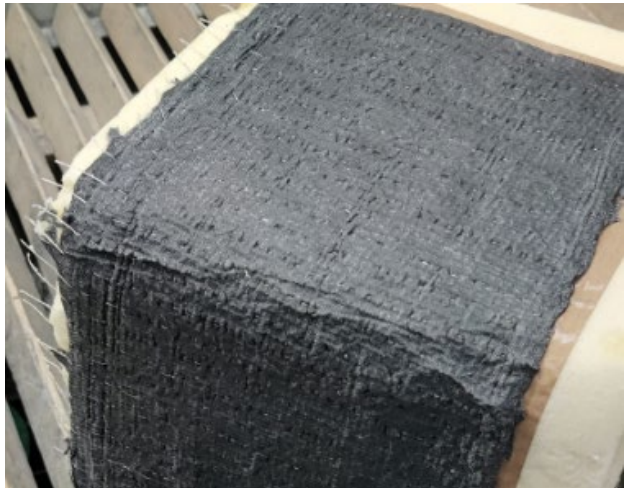
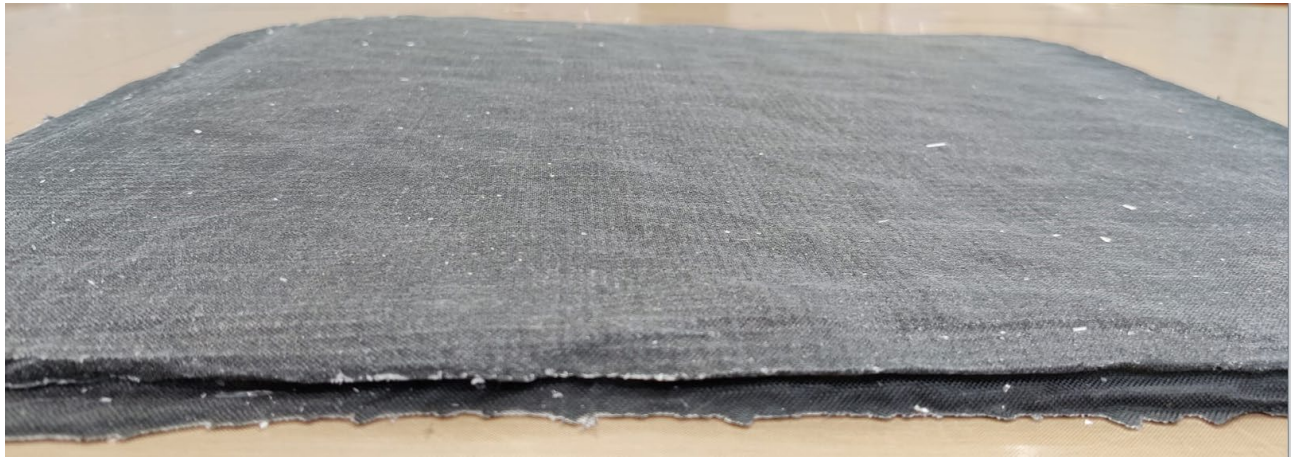
CRITICAL ISSUES IN PROCESSING







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TESTS

Manual lamination vs infusion

Manual

Infusion

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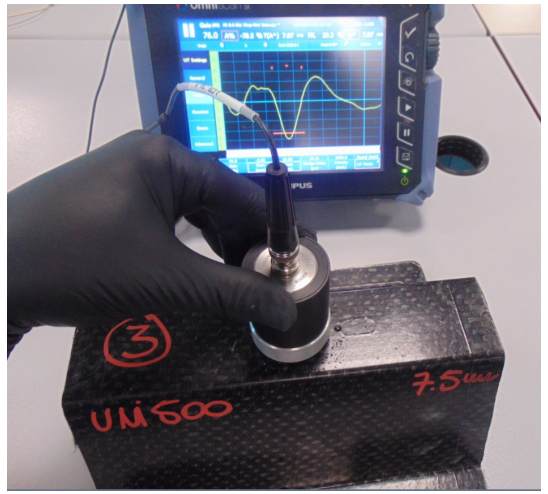
TESTS

Ultrasound

Using ultrasound testing, it became possible to evaluate the performance of the laminate obtained with the Ecocarbonio fabric compared to the performance of a compound made using a virgin pre-impregnated fabric.

NDT Analysis Datum Test

Test Spec	Eco C	Structures	Lamination	Thick	Gain	Ampl.	Vel.
No.	Type		Process	mm.	dB	%	m/s
#01	UNI 270	Omega	Infusione	11	81	84	2800
#02	UNI 500	Omega	Infusione	11	79	80	2800
#03	UNI 500	Omega	Infusione	7,5	76	80	2800
#04	UNI 270	Omega	Infusione	7,5	80	87	2800
#05	UNI 500	Omega	Infusione	7,5	79	80	2800
#06	Failed Test						
#07	UNI 300	Cup	PrePregs	2,9	67	91	2900
#08	UNI 150	Cup	PrePregs	3,51	67	82	2900
#09	UNI 150	Omega	PrePregs	3,40	65	80	2900
#10	UNI500 21030465	Lavabo	PrePregs	11,19	68	85	2900
#11	NO ID	Lavabo	PrePregs	4,63	68	87	2900
#12	NO ID	Lavabo	PrePregs	6,31	68	80	2900



In the tests on the recycled material, to increase the back-wall echo (BWE) to the 80% required for the tests, it was necessary to increase the decibel power (tests #01 to #06 – average gain of 80dB), whereas in the prepreg item (tests #07 to #12) the values necessary were lower (65-67 dB). The test highlights a C-type average porosity. The porosities are estimated at between 1% and 3%, which would be acceptable for the use of non-structural parts and the production of dies. The monitored data were confirmed by the subsequent test conducted by sectioning a part of the items for microscope analysis.

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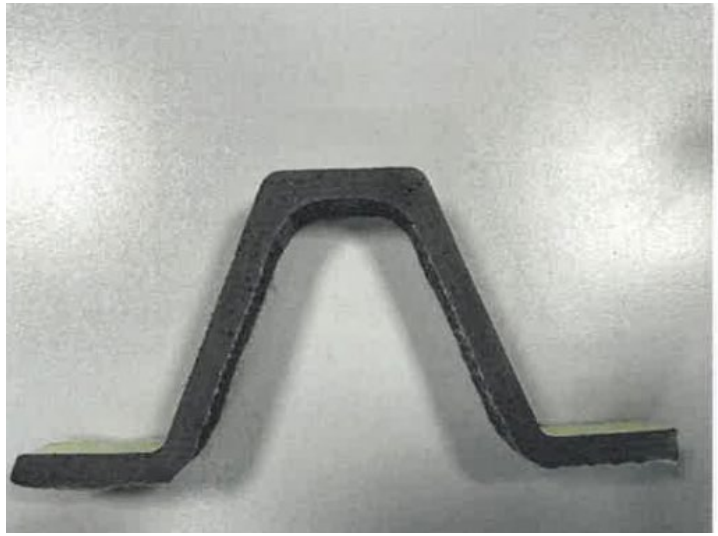
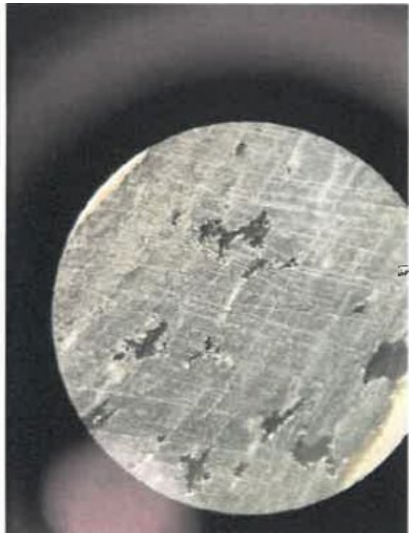
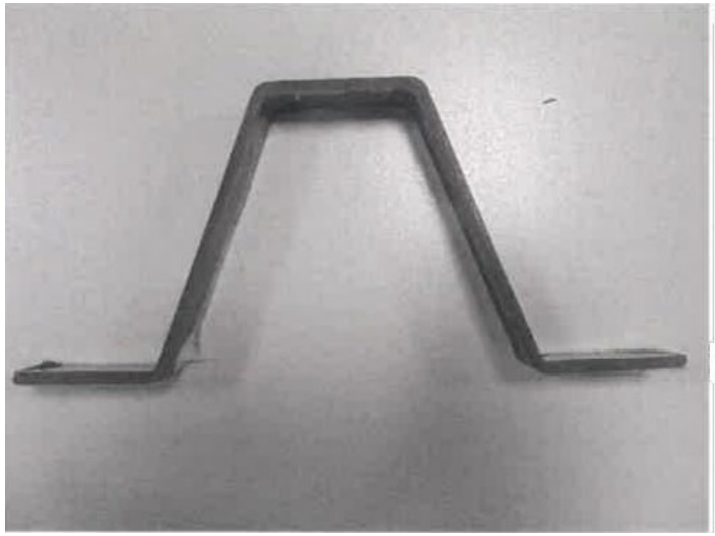
TESTS

Microscope (Pre-preg virgin fibers Vs. EcoCarbonio)





EcoCarbonio made with resin infusion



Pre-impregnated

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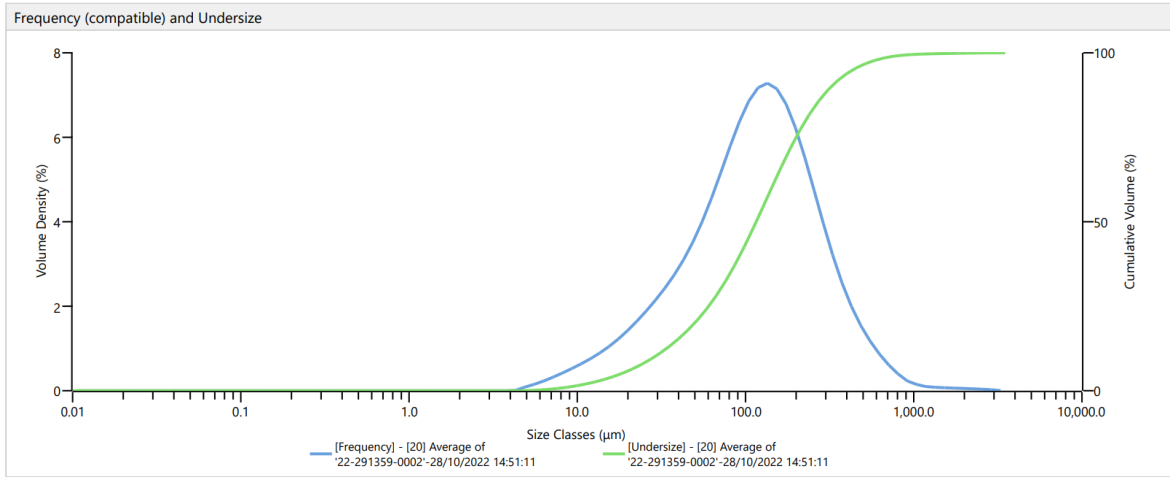
TESTS

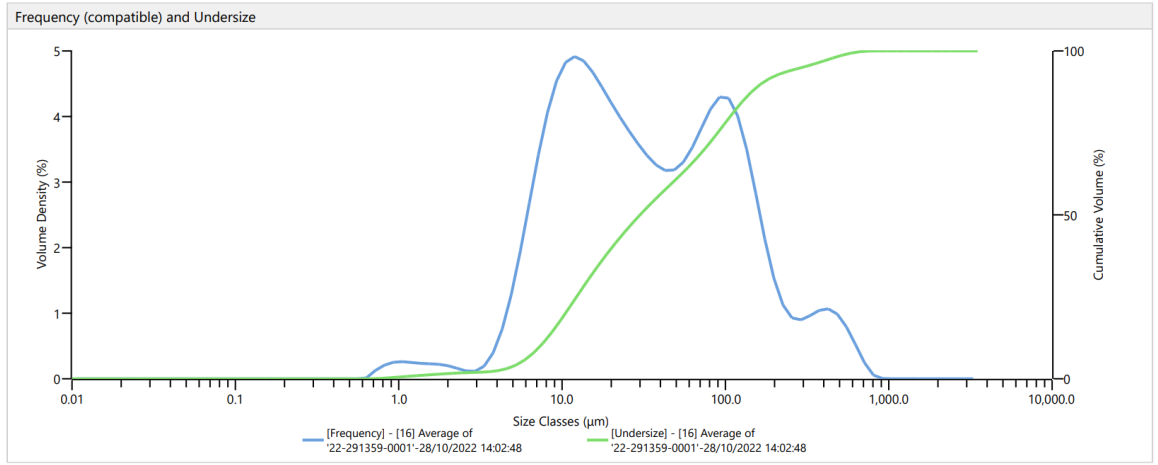
Granulometry (Pre-preg virgin fibers Vs. EcoCarbonio)

EcoCarbonio made with resin infusion



- Breathable particles = 0 %
- Inhalable particles = 48.26 %
- Non-inhalable particles = 51.78 %

Pre-impregnated



- Breathable particles = 3.08 %
- Inhalable particles = 78.1 %
- Non-inhalable particles = 18.85 %

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CONCLUSIONS

- In view of the properties of the products habitually manufactured by Persico Marine (high-performance structural components, made in single pieces or very small series) and of the technologies used for mannufacturing (cast lamination with pre-preg or resin infusion), the recycled material resulting from the project operations is difficult to use in the company's typical commercial applications.
- With the use of different manufacturing technologies that are capable of exploiting the opportunities afforded by the thermoplastic matrix already found within the weave of the fabric, such as compression molding, the material appears suitable for other applications.
- The presence of the thermoplastic matrix simplifies yet further every future action geared towards the recycling of components made from EcoCarbonio.
- Unfortunately for Persico Marine, these different technologies are suitable for the production of high volumes, but are not economical for the manufacture of small batches.