CARBISO M AND CARBISO TM: ELG CARBON FIBRE TURNS RECYCLED CARBON FIBRES INTO REINFORCEMENTS FOR THERMOSET AND THERMOPLASTIC COMPOSITES

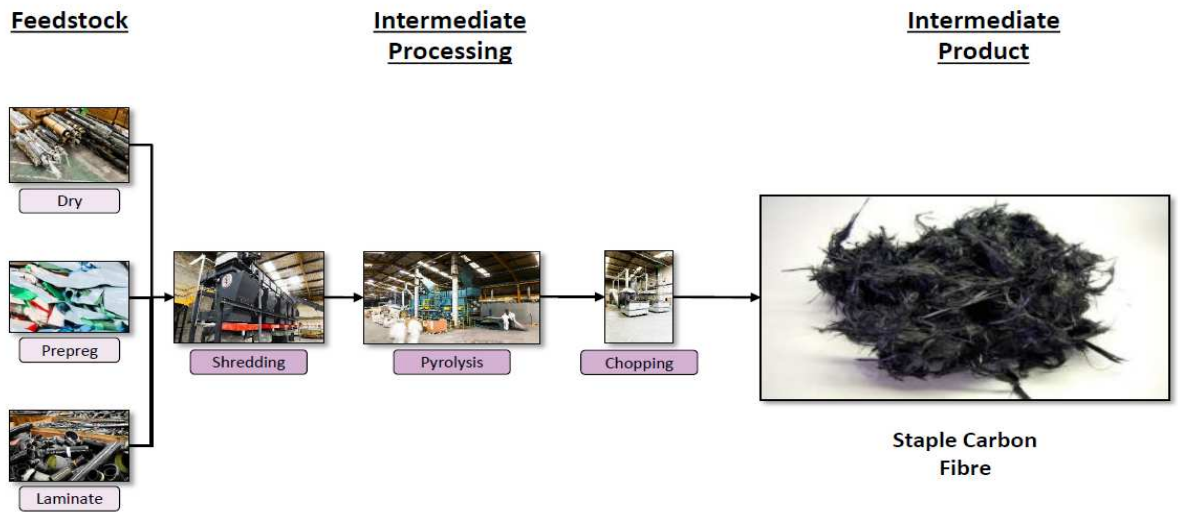
Marion Flahaut – Technical Services Engineer

From wastes to new composite reinforcement material ELG Carbon Fibre Ltd. manage to give a second life to carbon fibres. Basing its industrialisation on seven years of previous research, Coseley plant is reuniting more than sixty people from various backgrounds to support customer's projects and maintain leadership in technology and market knowledge. The paper offers an overview of the recycling process and how reclaimed materials are turned into nonwovens for thermoset and thermoplastic composites reinforcements.

1 Recycling process

In 2016, 24,000 tonnes of carbon fibre wastes were generated. They mainly came from aerospace sector and are available in different forms. From dry to cured wastes, ELG CF was able to recycle 25 percent of it to turn them into new products.

In a first stage wastes are sorted by types as they will not follow the same processing routes. Some dry fibres as tows or bobbin ends will be directly turned into commercialised materials (Carbiso C, CT, CT+). Prepregs or cured laminates may have to be shredded and put through a modified pyrolysis process. High temperatures up to 800 degrees Celsius allow the resin and other combustible contaminations to turn into smokes[1].



To insure fibres quality and allow fibres classification, single filament test is conducted to control the effect of the pyrolysis and the mechanical properties of the

[1] ELG CF is accredited to ISO 9001:2008 and 14001:2015 following waste management emissions.

feedstock used. It is currently seen a reduction of four percent in tensile strength and two percent in tensile modulus post furnace. The reclaiming process will be fully optimised for each type of feedstock.
Regarding the classification it has been introduced to provide customers with an universal language of ELG's products.

From the pyrolysis process, fibres are chopped to specific lengths which will satisfy customers need for compounding or composites applications. It will form another grade of CarbIso C and CT.

From CarbIso C (random chop) nonwoven will be manufactured thanks to a carding process.

2 Transformation of the wastes into nonwovens

Carding is a transforming process historically created for wool and cotton. It has been extended throughout the years to the use of thermoplastic fibres, glass fibres, carbon fibres and now recycled carbon fibres. Opening, blending and carding steps will be adjusted to each feedstock type to provide consistent and reliable final product from batch to batch.

Once cross lapped, the multi-layered web is mechanically consolidated by needle punching.

Carding and entangling are two crucial steps as they will directly impact on the fibre length, alignment and thus entangling. There is a fine balance to find in order to preserve intrinsic properties of the mat.

Then edges are slit to provide the desired width on the roll.

A scanning system has been implemented in 2017. A beta-ray source is measuring in real time the areal weight of the mat and allow the process to be controlled from start to end.

Either made with hundred percent of recycled carbon or comingled with a certain percentage of thermoplastic fibres, Carbiso M and Carbiso TM respectively are suitable for thermoset and thermoplastic processes. The last section presents some examples of applications where ELG CF nonwoven mats have proved their functionalities.

3 Commercial applications for thermoset and thermoplastic mats

Either Carbiso M or Carbiso TM show a good drapability and are suitable for thermoset and thermoplastic moulding processes. It is predominantly used for non-structural and semi-structural parts in automotive but also suitable for railway, aircraft interiors and electronical applications.

From epoxy prepregs using Carbiso M, Gurit manufactured some structural inner forms suitable for high volume compression moulding. A class A finish is obtainable in conjunction with complex, sharp-bended shapes for detailed featured parts.

Carbiso TMPA6 has been used for manufacturing seat backs. They are typically 75% lighter than a steel frame which is leading to a cost per kilogram of weight saving of $2.5.

New uses of Carbiso nonwoven range will increase in the coming years to strengthen the current studies confirming the technical, environmental and commercial availability of recycled carbon fibre.

There is obviously no boundaries and ELG will be happy to support any new product/ideas into the carbon market.

4 References

Agency, E. (n.d.). *Carbon Recover Plant.* The Environmental Permitting (England and Wales) Regulations 2007.

Chuck Segal, C. R. (n.d.). Global Outlook for Carbon Fibre The Past (2010), the Present (2015), and the Future (2020). *Composites Forecast ad Consulting* .

Components, G. C. (2017). Automotive component: lightweight innovation. 2.

ELG Carbon Fibre . (n.d.). Retrieved from elgcf.com : http://www.elgcf.com/

Ltd., A. E. (2015). *ISO 9001:2008.* SGS.

Ltd., A. E. (2016). *ISO 14001:2015.* SGS.