Reinforced Plastics • Volume xx, Number xx • xxxx xxxx www.reinforcedplastics.com

ELSEVIER

Recycled carbon fiber composites become a reality

Mark Holmes

Wider use of carbon fiber in the composites industry is now a possibility through the introduction of recycled materials. *Reinforced Plastics* reports on the development of recycled carbon fibers by ELG Carbon Fibre and how some key industrial partners are using them.

One company developing its own market space in the composites industry at present is ELG Carbon Fibre. Part of the Haniel Group, ELG is one of four corporate divisions with totally different activities, including Bekaert Textiles which was acquired in 2015. The Haniel Group had sales of €4 billion in 2014. ELG specializes in trading and recycling of raw materials, in particular for the stainless steel industry. Split into three business units, one handles stainless steel scrap while a second, ELG Superalloys, recycles high-nickel alloys and has pioneered recycling of titanium for the aerospace industry. The third unit in the group handles other high-performance materials, such as ferrochrome and carbon scrap, and in 2010 made the decision to seek recycling opportunities in the carbon fiber market.

Based at Coseley, near Wolverhampton in the United Kingdom, ELG Carbon Fibre now has 60 employees and a 4,000-square meter warehouse can contain approximately 1,000 tonnes of carbon fiber feedstock (see Figure 1). "Originally the base business was milled carbon fiber for coatings, primarily for the oil and gas industry," says Managing Director Frazer Barnes (Figure 2). "However, we needed to diversify because of the downturn in the oil industry. Replacing virgin carbon fiber with recycled material is not a simple substitution. Recycled carbon fiber is a very different product – lightweight and fluffy – and a difficult material to handle. There have been a lot of challenges and a need to modify equipment. For example, the electrical system in the plant needed attention, because of the very fine fibers. Nevertheless, we are now in a position where we are supplying the composite and compounding industries with recycled carbon fiber."

ELG Carbon Fibre needed to pass a number of milestones along the way to reach the current position. Since 2012 the plant's infrastructure and processes have been transformed and BS: EN 9100 QMS accreditation was achieved in 2015. From mid-2013 the company began developing new recycled carbon fiber products and passed the 1,000 tonnes annual production level at the start of 2016. The first nonwoven recycled carbon fiber materials were produced in the middle of 2016. ELG Carbon Fibre began developing applications for the new nonwoven recycled materials in 2014. Materials for automotive were supplied to Gordon Murray Design for use in iStream platforms for OEMs such as TVR and Yamaha in 2015, and to Alstom for composite bogies in the rail industry at the beginning of 2017. The production of recycled carbon fiber materials for composites began in 2015 and the company secured its first automotive production

FIGURE 1

ELG Carbon Fibre 4,000 square meter warehouse can contain approximately 1,000 tonnes of carbon fiber feedstock.

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Please cite this article in press as: M. Holmes, (2017), https://doi.org/10.1016/j.repl.2017.11.012

FIGURE 2

Frazer Barnes, Managing Director of ELG Carbon Fibre.

contract in early 2017. In September 2017, ELG Carbon Fibre also extended the certification of its quality management system to BS: EN9100 2016 (AS9100 Revision D) standard. This now covers design and development activities – important for high volume applications, particularly in the automotive sector.

The recycling process

Carbon fiber reclamation initially involves metal removal and cutting of large composite structures to sizes suitable for downstream processing. Shredding of laminates and prepreg enables efficient and consistent processing, with the shredder able to prepare up to four tonnes per hour (see Figure 3). Fiber recovery is achieved through a modified pyrolysis process, where the resin is burned off (see Figures 4 and 5). The furnace is capable of providing an output of 1,500 tonnes per year. The carbon fiber is then converted through milling, nonwoven mat production and pellet production. "When we started the project, the design of the line was based on what equipment suppliers believed would work best with carbon fiber," says Frazer Barnes. "As we started to run the line, we got a better understanding of the interdependencies between different parts of the line to maximize production rates and optimize product performance."

Carbon fiber recovery has grown from under 200 tonnes in 2012 to nearly 1,100 tonnes in 2015. Feedstock is primarily unused prepreg, however, the process is also suitable for cured production waste and end-of-life materials. The company says that it has established relationships with long term suppliers. This is essential to meet the requirements of OEMs in the

FIGURE 3

Carbon fiber reclamation starts with the shredder.

FIGURE 4

Fiber recovery is achieved through a modified pyrolysis process.

FIGURE 5

Feeding reclaimed carbon fiber to the furnace.

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