ASPECTS OF THE DEVELOPMENT OF THERMOSET COMPOSITES BASED ON YARNS AND FABRICS WITH HIGH RECYCLED CARBON FIBRE CONTENT

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Abstract: Due to the growing demand and use of carbon fibre (CF), effective methods to reuse waste and recycled carbon fibre (rCF) from either process scrap or end-of-life components are attracting increased attention. The development of various hybrid yarn structures consisting of rCF and thermoplastic fibres (rCF content approximately 50% by weight) for thermoplastic composites has been reported previously. However, yarns with high recycled carbon fibre content (> 90% by weight), as required for thermoset composites, are still not realisable due to high rCF length shortening ($\geqslant$ 70%) during various spinning processes due to the low shear strength, smooth fibre surface and high brittleness of rCF. Secondly, the lack of crimp in rCF leads to drafting errors during the drawing and spinning process. Therefore, the aim of this work is to develop innovative yarns and fabric structures with high rCF content (> 90% by weight) for thermoset composites. To this end, ITM has developed a new process chain from spinning to the production of thermoset composites based on rCF [1], [2]. 100% rCF could be gently (fibre shortening < 10%) processed into card and drawn slivers with very good homegeneity (CV_{1m} < 2%). Based on the drawn sliver wrap and friction spun yarns were developed with high rCF content (> 90% by weight) and the rCF friction spun yarn was processed into 2/2 twill weave structures (Figure 1). The tensile properties of uni-directional composites based on rCF yarns and woven fabric show very good potential for their use in load bearing structures. The presentation will focus on various technical aspects of processing 100% recycled carbon fibres based on carding, drawing, spinning and fabric as well as thermoset composites manufacturing processes. This research is expected to make an important contribution to the circular economy of rCF recycling.

Keywords: *Recycled carbon fibre, spinning, thermoset composites.*

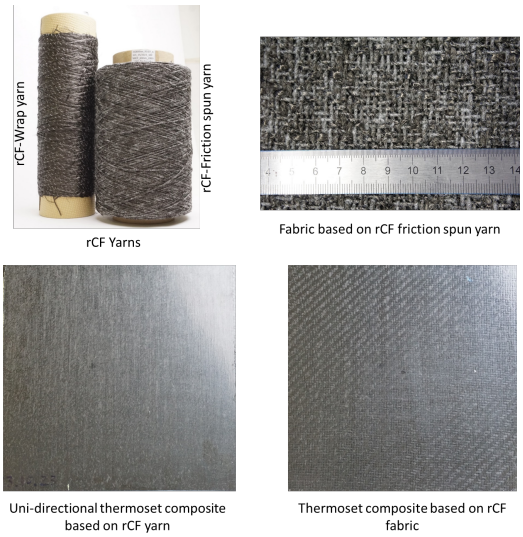

Figure 1: Developed rCF yarns, fabric and composites

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REFERENCES

[1] Abdkader, A.; Bachor, S.; Hasan, M. M. B.; Cherif, C.: Development of yarns from recycled carbon fiber based on friction spinning technology with specific properties for thermoset composites, Textile Research Journal, 00405175231198272, 2023.

[2] Hasan, M. M. B.; Bachor, S., Abdkader, A., Cherif, C.: Tensile properties of thermoset composites based on yarn structures from recycled carbon fibre and low melting temperature Co-polyamide fibre, Journal of Composite Materials, 00219983231217138, 2023.