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Recycling of carbon reinforcement: analysis of fibres and possibilities of re-utilization

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Abstract

Thorough analysis of the structure and properties of recycled carbon fibres was the main goal of the study. The influence of recycling processes on the fibres was analysed, the structural and material parameters of the fibres were compared to the virgin ones. Finally the efficiency of the fibres as composite reinforcement was evaluated.

Key words: *Carbon fibres, Carbon fibre reinforced composites, Pyrolysis, Thermal decomposition, Recycling*

1. Recycling of carbon fibres

Carbon fibre reinforced polymer matrix composites are materials with superior strength-to-weight ratios. Finding widespread use in various application fields the production of these materials increases year by year. However relatively high costs along with the concerns about the composite recycling once the product reach its life-end are still barriers to its common use. The efficient and cost-effective process of recovering valuable carbon fibres and dismiss the landfill disposal are topical problems. If we focus on the reclaiming of the reinforcing fibres we would do it only with the prospects of cost efficient reclaiming processes. We expect the recycling costs will be covered at the market price of recycled fibres. It is assumed the carbon fibres will be reclaimed from the composites with minimum impacted material properties and in a multifilament form if it was the form of virgin reinforcement. There are several technologies dealing with a thermal treatment process to degrade the polymer substrate and recover the carbon fibres from the composites (Giulvezan and Carberry, 2003; Ning *et al.*, 2008; www. milledcarbon.com). Yet the reclaimed carbon fibres are mostly in short fibre form (chopped, milled, or shredded). It is the reason why the modified recycling process, based on thermosets thermal decomposition, is being developed in VZLU1. The main focus is the reclaiming of multifilament carbon reinforcement see Figure 1.

1. 1. Thermal decomposition process

Basic description of the decomposition process was given in (Valeš and Štekner, 2006; Valeš *et al.*, 2007). The thermal decompositions of thermosets were carried out at temperatures ranging from 550°C to 650°C under inert (nitrogen) or oxygen atmosphere. The resultant fibrous

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