MODIFICATION OF GLASS/EPOXY LAMINATES USING MICRO/NANO PARTICLES FROM CARBON WASTES

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Fibre reinforced plastics (FRP), especially those made from inorganic multifilaments and polymer matrices, belong to the most popular materials for structural application, because they perfectly combine lowest possible weight and high load capacity. While their technical advantages are undisputed, in recent years much attention has been paid to environmental problem they cause, when disposed in landfills at the end of their lifetime. This problem is particularly acute with thermoset matrix composites. Although there are numerous attempts to their recycling, suitable technologies are still lagging behind the growing amount of composite waste [1]. Therefore, the development of new "environmentally friendly"FRP is one of the fastest growing R&D area in composite research.

Promissing solution is offered by various binder modifications. Many recent studies present possibilities of improvement for "green"resins or "bio-based"thermo-plastics, often based on using different combinations of micro/nanofillers, mainly those made from recycled sources. Especially carbon/graphite particles of various shapes and sizes seem like very promising material [2]. Usual filler volume in structural plastics ranges between 15-40wt% depending on the production technology, and requirements on utility properties of final composite product. However, such filler amount is unusable in the resins that serve as the binder for FRP due to striking increase of the resin viscosity. We observed this increase already at a concentration around 3wt% [3].

Our study is therefore focused on influence of selected carbon particles on composite properties in perspective of appropriate balance between the matrix modification and processing requirements in FRP production. We build on our previous research in the development of fibrous assemblies and structural composites from recycled sources [3]. For this study we modified green epoxy resin with 2.5wt% of carbon based fillers. The resin was subsequently applied to glass multifilaments, and vacuum cured to obtain glass fiber/epoxy laminates.

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[1] Krauklis AE. Composite Material Recycling Technology-State-of-the-Art and Sustainable Development for the 2020s. Journal of Composite Science 2021; 5(28):1-33.

[2] Gajapriya M, et al. Fillers in Composite Resins – Recent Advances. European Journal of Molecular & Clinical Medicine 2020; 7(1):971-977.

[3] 3. Tomkova B, et al. Limits of carbon micro/nano particles utilization to improve properties of polymer matrices in fibre reinforced composites. IOP Conf. Series: Materials Science and Engineering 2019; 459:1-6.