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Validation of carbon fibers recycling by pyro-gasification: the influence of oxidation conditions to obtain clean fibers and promote fiber/matrix adhesion in epoxy composites

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Abstract

This work aims at demonstrating, at a pilot plant scale, the potential of the pyro-gasification process to produce carbon fibers (CF) as secondary raw materials. The solid residue obtained upon pyrolysis was characterized and oxidized, applying different process conditions to provide clean fibers. The same process was applied to virgin fibers, thus highlighting the protective action that char provides to CF during the oxidation step. The recovered fibers were used to produce new short fiber composites which, upon optimization of the mixing and curing conditions, were competitive with the performance of pristine fibers composites. Indeed, the oxidation leaves an oxygen rich surface which positively interacts with the epoxy resin, thus promoting adhesion without the requirement of an additional sizing process after the CFs recycling. These results provided sufficient validation of the recovered CF quality, thus leading to the scale up of the process to produce an integrated pyro-gasification semi—industrial plant.

Keywords: carbon fibers; recycling; Process monitoring; fiber/matrix bond

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