Poster

Determining the influence of material structure and sizing on the comminution behaviour of carbon fibres

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ABSTRACT

With the steadily increasing demand for carbon fibres (CF) and carbon fibre reinforced plastics (CFRP), the amount of CFRP waste to be recycled at the end of life is rising. Essential for all optional recycling processes is the homogeneous and reproducible comminution of CF, as well as the knowledge of the dependencies of the comminution behaviour on the material properties of the CF.

For this purpose, an evaluation routine was developed, consisting of a sample preparation of the milled CF, image generation by optical digital microscopy, automatic image analysis and data post processing. This allows the automatic evaluation of up to 15,000 objects per sample and their categorization according to particles (length (L)/diameter (D) < 3), fibres (L/D > 3) and WHO fibres (L/D > 3; L ≥ 5 µm; D ≤ 3 µm), using automatic image analysis software FibreShape (IST AG, Switzerland).

In this study three different CF based on polyacrylonitrile and one based on mesophase pitch were crushed in a planetary ball mill at selected specific energy inputs while varying the speed and the treatment duration, and the comminution behaviour was compared with the mechanical fibre properties. In another series of tests, the same CF were pyrolyzed prior to mechanical grinding to determine the influence of sizing on the comminution behaviour of the CF.

The tests showed that the influence of the sizing on the comminution behaviour of CF is significantly greater than that of tensile strength and Young's modulus. It should be mentioned that respirable fibre fragments were generated in all comminution tests, which should be taken into account with regard to health hazards in the mechanical treatment of CF.

In further studies, additional CF will be investigated with respect to their mechanical comminution behaviour, using further analytical methods.