Karlsruhe Institute of Technology

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

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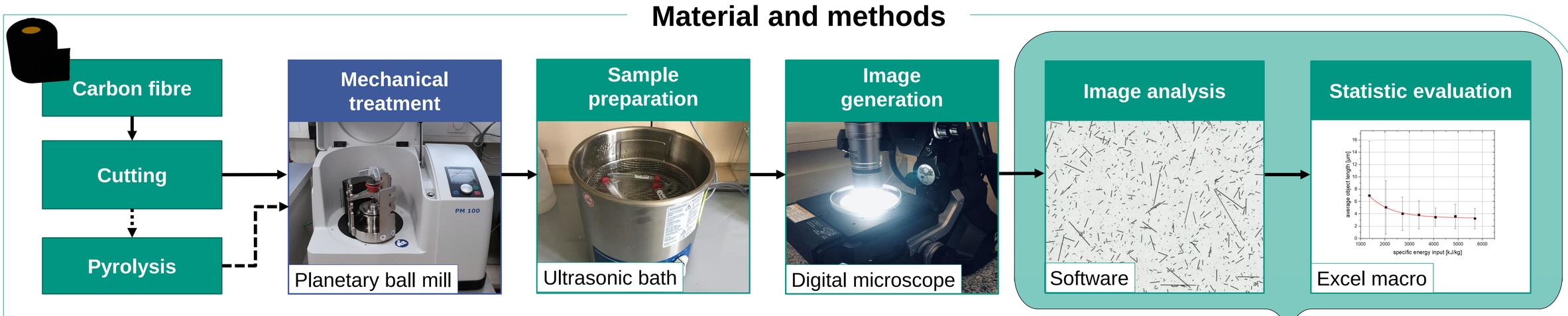
Backround

With the steadily increasing demand for carbon fibres (CF) and carbon fibre reinforced plastics (CFRP), the amount of CFRP waste to be recovered at the end of its life is rising. The Knowledge of the dependencies of the comminution behaviour of CF on their material properties, taking into account the possible generation and release of respirable fibre fragments (WHO fibres) during shredding, is essential for all optional recycling and recovery processes.

Material and methods

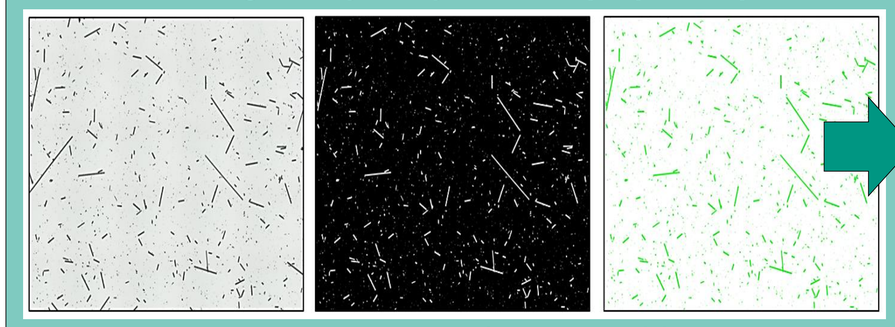


Fibre selection

Fibre type	Precursor material	Tensile strength [MPa]	Young's Modulus [GPa]
HTS[1]	PAN[5]	4000	240
IM[2]	PAN	6964	310
HM[3]	PAN	4700	390
UHM[4]	MPP[6]	2600	640

1: High Tensile Strength
2: Intermediate Modulus
3: High Modulus
4: Ultrahigh Modulus
5: Polyacrylnitril
6: Mesophase pitch

Image analysis by FibreShape (IST AG)



Light microscope image

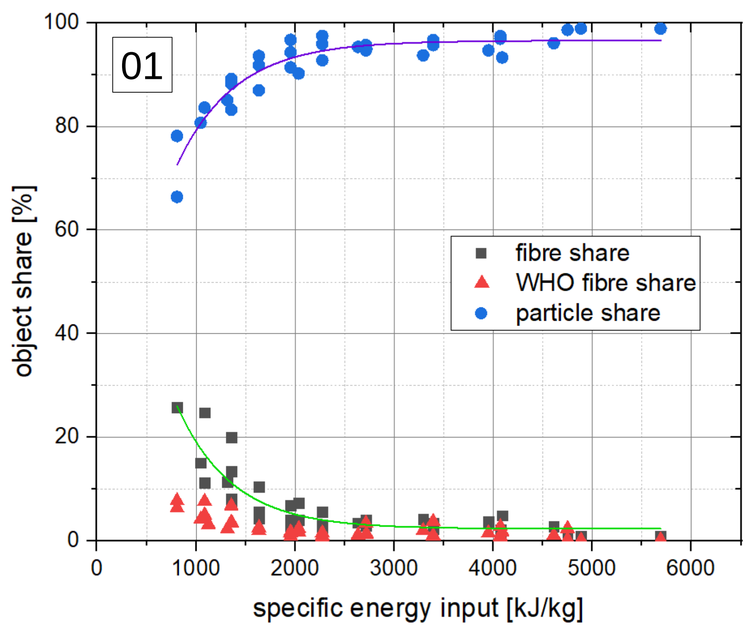
Generated binary image

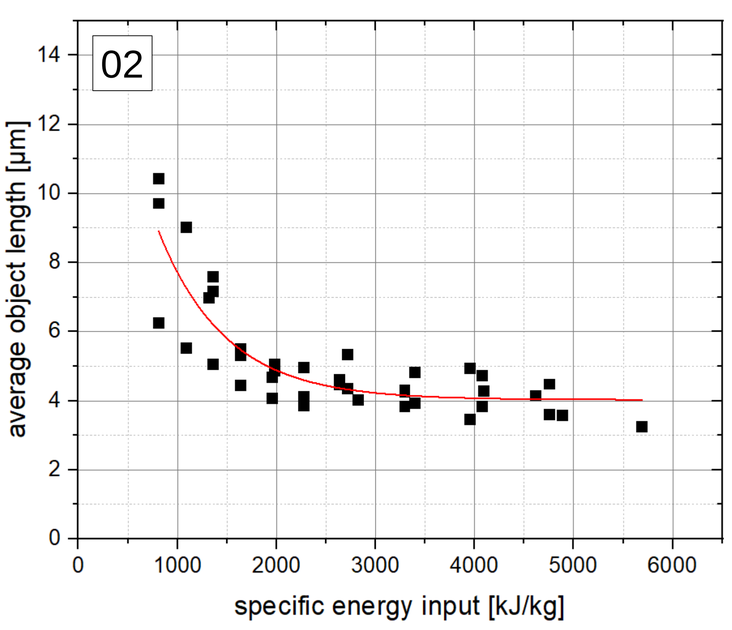
Objects detected and measured with blob analysis

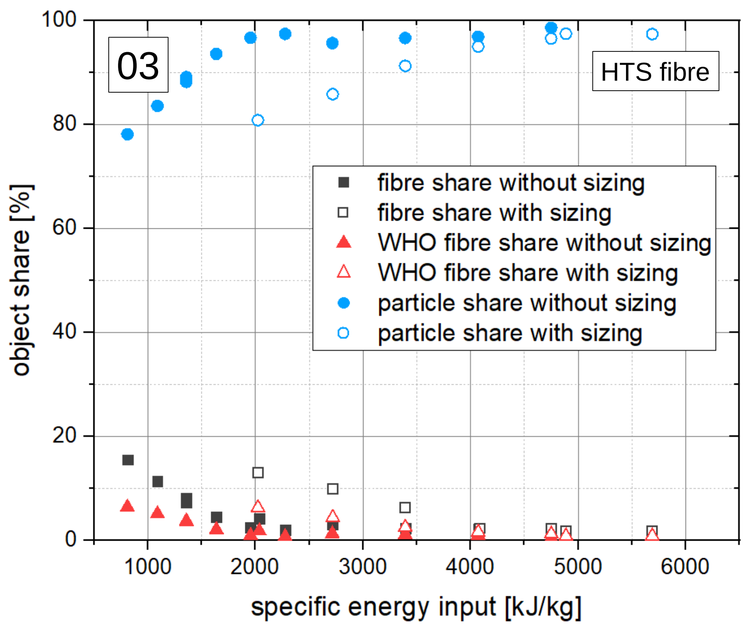
Statistic evaluation

1. Sorting out "agglomerates"
2. Classification of objects into "fibres", "WHO fibres" and particles"
3. Number determination
4. Geometry evaluation (object length and diameter)

Results







01 With increasing specific energy input, the fibre share and WHO fibre share decrease and the particle share increases.

02 With increasing specific energy input, the object length distribution shifts to smaller values.

03 To achieve the same grinding result, higher specific energy inputs are required for CF with sizing (coating) than for CF without sizing.

- No correlation was found between the mechanical properties (tensile strength, Young's Modulus) with the comminution behaviour of the investigated CF and further investigations will be carried out.

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