

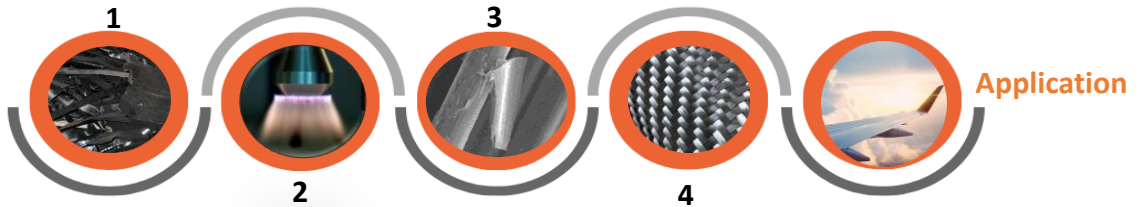
# New sizing strategies to improve recovered carbon fibres reinforcement on polymer composite

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## Introduction

Carbon fibres (CFs) are the most widely used fibres in polymer composites for high-performance applications. The composite materials' performance is determined, among others, by fibre-matrix interaction, which is hindered after recycling processes. CUSTOMISIZE European project aims to overcome this challenge by modifying rCF surface to improve the interfacial adhesion between both fibre and polymer matrix.

## Methodology

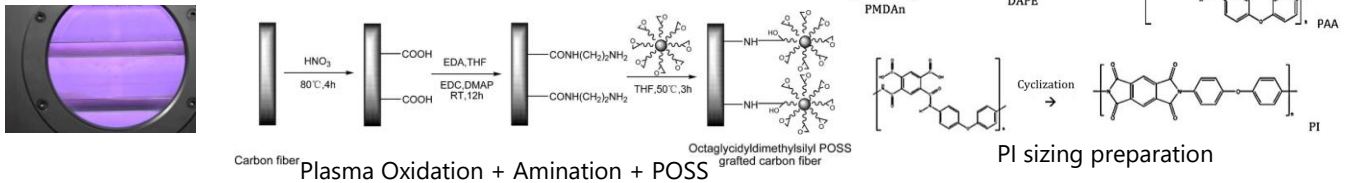


1. Carbon fiber waste recovered by Steam Water Thermolysis (SWT) and pyrolysis
2. **Low-pressure plasma treatment** to prepare and activate the rCF surface
3. **Sizing strategies** Thermoset (Epoxy and PU): Amination, POSS and silanization. Thermoplastic (PEKK and PPS): PI and PEI
4. **Composite preparation and characterization** by injection moulding for chopped fibres and Resin transfer moulding for woven and non-woven. Thermoset composite characterization by ASTM D5379 (iosipescu test)

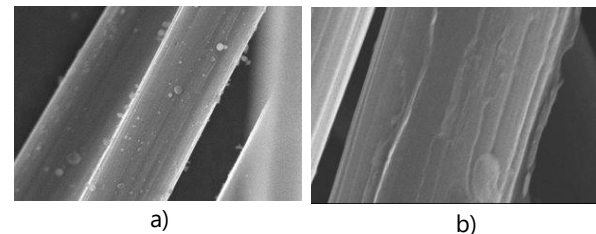
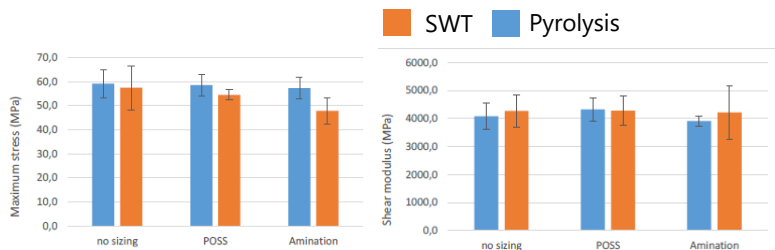
### Chemical and plasma oxidation

**Chemical oxidation:** Concentrated  $\text{HNO}_3$  @80 °C for 4h, washed 5% NaOH  
**Plasma oxidation:** Air and helium / 500 W / 15-20 min  
**Plasma amination:** Ar and  $\text{N}_2$  / 500 W / 20 min

### Sizing strategies

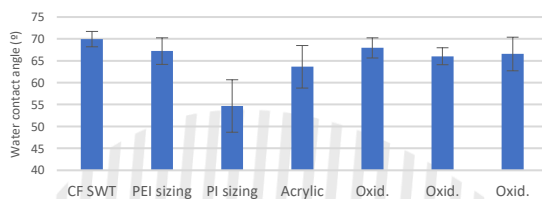


## Results and conclusions



SEM images of SWT Sizing PI a) solution method b) solution method (homogeneous film)

### Water contact angle for rCF from SWT



The untreated rCF obtained from SWT presented the lowest **wettability** and the different sizing and plasma oxidation have successfully increased the wettability. Plasma oxidation is not lost during the first 20 days after treatment

### XPS

	O/C	N/C	OH [%]	N-H [%]
rCF	0.248	0.098	31.5	56.6
Chemical ox	0.253	0.054	51.5	55.4
Plasma ox	0.264	0.085	52.3	54.8
Chemical am	0.30	0.113	38.5	71.5
Plasma am	0.26	0.112	34.7	71.8

OH content ↑  
O/C ratio ↑  
N/C ratio ↑  
amine content ↑