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Improving the interfacial properties for carbon-matrix composites by self-assembly of plasma-modified carbon fiber with graphene oxide

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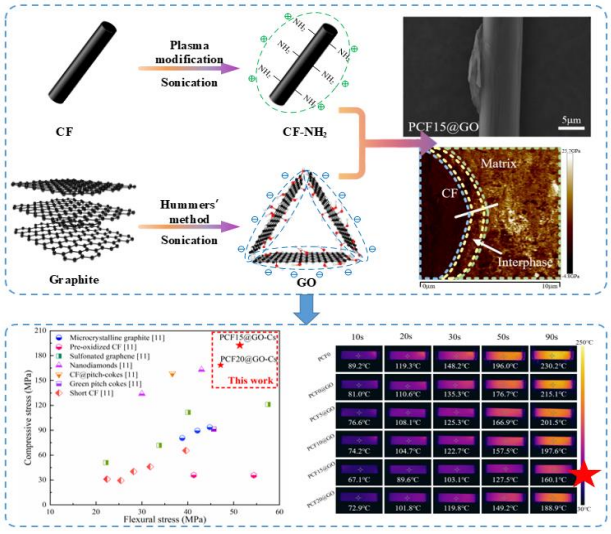
Carbon fiber reinforced carbon matrix composites were widely used in military, aerospace and railway applications[1-3], but the poor interface between the fiber and the matrix severely limits further performance improvements.

Herein, a simple and efficient method was proposed to construct excellent interfaces between carbon fiber and matrix by plasma. Ammonia plasma-modified CF electrostatically self-assembled with graphene oxide (GO) in solution to form the new enhanced phase PCF@GO.

The results showed that GO coated on CF increased the tensile strength of CF by 12.3%, owing to the etching effect of the plasma eliminating fiber surface defects and providing repair sites for GO. Compared with the pristine material, the compressive strength (192.44 ± 1.82 MPa) and flexural strength (51.34 ± 0.39 MPa) of PCF15@GO reinforced carbon-matrix composites increased by 142.37% and 125.18%, respectively. This was mainly attributed to the ideal interfacial bonding and gradient interphase formed by PCF@GO with the pitch matrix, which could transfer the load from the matrix to CF. Meanwhile, the composite could keep a low temperature under current loading due to the good interface which reduced the electrical resistivity and increase the thermal conductivity of the composites. A strategy for the preparation of advanced composites with high mechanical strength and low working temperature is provided.



Figur. Graphic abstract for plasmas-treatment based performance improvement for the carbon composites

References

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