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Carbon microfiber surface modification using PECVD

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Ultra-lightweight materials are a keystone for the construction of future energy efficient vehicles and machines. Carbon microfibers are widely used in lightweight hybrid materials as they allow to combine the properties of the polymer or metal matrix with the mechanical strength of the fiber. In order to allow for an efficient coupling of forces into the fiber, the fiber/matrix interface has to be designed for stability and durability. Therefore surface properties such as the wettability and chemical reactivity of carbon microfibers are a key to their application in lightweight fiber reinforced composites. While plasma treatment is frequently used to clean and activate fibers, little is known about plasma enhanced chemical vapor deposition (PECVD) of thin films on carbon fibers.
In this contribution we demonstrate by a systematic study that PECVD can be used to change the carbon fiber surface composition. To this end, commercially available carbon microfibers were processed in a SiH4/Ar/N2O RF plasma at 1000 mTorr using an Oxford Instruments Plasmalab80 Plus PECVD reactor, aiming to add thin layers of different thicknesses of silicon oxide on their surface.
The modified carbon fiber's surface properties are investigated using scanning electron microscopy to see changes in the surface morphology, energy dispersive X-ray spectroscopy to monitor the chemical composition and fiber tensiometry to study changes of the contact angle and wettability of individual fibres.
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