Accepted Manuscript

Title: A Novel Multiscale Reinforcement by in-Situ Growing Carbon Nanotubes on Graphene Oxide Grafted Carbon Fibers and Its Reinforced Carbon/Carbon Composites with Improved Tensile Properties

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PII: S1005-0302(15)00237-6
DOI: http://dx.doi.org/doi: 10.1016/j.jmst.2015.12.022
Reference: JMST 631

To appear in: *Journal of Materials Science & Technology*

Received date: 2-8-2015
Revised date: 11-11-2015
Accepted date: 23-11-2015

Please cite this article as: Yunyu Li, Ling-jun Guo, Ya-wen Wang, He-jun Li, Qiang Song, A Novel Multiscale Reinforcement by in-Situ Growing Carbon Nanotubes on Graphene Oxide Grafted Carbon Fibers and Its Reinforced Carbon/Carbon Composites with Improved Tensile Properties, *Journal of Materials Science & Technology* (2015), http://dx.doi.org/doi: 10.1016/j.jmst.2015.12.022.

A Novel Multiscale Reinforcement by In-situ Growing Carbon Nanotubes on Graphene Oxide Grafted Carbon Fibers and Its Reinforced Carbon/carbon Composites with Improved Tensile Properties

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[Received 2 August 2015; Received in revised form 11 November 2015; Accepted 23 November 2015]

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In-situ growing carbon nanotubes (CNTs) directly on carbon fibers (CFs) always lead to a degraded tensile strength of CFs and then a poor fiber-dominated mechanical property of carbon/carbon composites (C/Cs). To solve this issue, here, a novel carbon fiber-based multiscale reinforcement is reported. To synthesize it, carbon fibers (CFs) have been firstly grafted by graphene oxide (GO) and then carbon nanotubes (CNTs) have been in-situ grown on GO-grafted CFs by catalytic chemical vapor deposition. Characterizations on this novel reinforcement show that GO grafting cannot only nondestructively improve the surface chemical activity of CFs but also protect CFs against the high-temperature corrosion of metal catalyst during CNT growth that maintain their tensile properties. Tensile property tests for unidirectional C/Cs with different preforms show that this novel reinforcement can endow C/C with improved tensile properties, 32% and 87% higher than that of pure C/C and C/C only doped with in-situ grown CNTs. This work would open up a possibility to