Mohammad S Islam, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C4-022

22nd International Conference on
ADVANCED MATERIALS AND NANOTECHNOLOGY
September 19-21, 2018 Tokyo, Japan

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Nanomaterials in polymer composites for applications from aerospace and corrosion protection to energy storage

Nanomaterials used in fiber-polymer composites lead to a marked improvement in performance of the materials used in various applications, including aerospace, corrosion protection and energy storage. Nanomaterials (e.g. carbon nanotubes) grafted on fibers show increased interfacial adhesion to polymer matrix when compared to non-grafted fibers, thus providing increased strength and toughness to the composites. The characterization of pulling out behavior of nanomaterials and the corresponding failure mechanism is significant for the design of high-performance hierarchical nanocomposites for aerospace applications. Microcracks in carbon fiber composite materials can severely degrade the mechanical strength and gas permeability of composites, posing a significant challenge to the use of fiber composites in liquid fuel tanks of launch vehicles. Nanomaterials (e.g. nanosilica) can be used to enhance the fracture toughness and reduce the coefficient of thermal expansion of the polymer matrix in the composites used in liquid fuel tanks. Damage to gas and liquid transport pipelines (excluding water and sewerage pipes) caused by corrosion was estimated to cause costs in excess of 7 billion dollars a year for the United States of America. Against this backdrop corrosion protection and in particular rehabilitation of corroded pipelines is of great importance. Nanomaterials (e.g. nanoclay) based glass fiber reinforced composite overwraps are used to repair corroded pipelines with a short amount of time and without disruption of the fluid transmission in the piping system. Finally, the electrochemical performance of flexible energy storage devices depends largely on the active materials and electrode structures. Nanomaterials (e.g. metal oxide) and their composites with or without flexible textile fibers have been studied as electrodes for supercapacitors and lithium ion batteries with favorable properties.

Biography

Mohammad S Islam has completed his PhD from the University of Waikato, New Zealand. He is currently a Research Fellow in the School of Mechanical and Manufacturing Engineering, University of New South Wales, Australia. He has worked as a Research Fellow at the University of Sydney in Australia, the University of Minho in Portugal, CSIRO Materials Science and Engineering in Australia and Materials Scientist position in Pultron Composites, New Zealand. He has published more than 25 papers in journals and has been serving as an Editorial Board Member of *Composite Materials* of Science Publishing Group.

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