

Nanofiber composites for structural and energy storage applications

Nanomaterials play an important role in the development of nanotechnology. They possess unique mechanical, physical, and chemical properties coupled with small size and ultrahigh surface area that can provide critical advantages for applications.

Nanofibers are being considered for a broad range of applications ranging from advanced filters, separation membranes, ultrasensitive sensors, micro/nano actuators, nanopores, tissue engineering scaffolds, protective and smart clothing, and multifunctional composites (1). They also find applications in engineered composite materials applied in land, sea and air transport vehicles, space explorations, military equipment and defence, storage, buildings and construction. Most of these applications require certain mechanical properties and robustness (2). However, reports on the mechanical behavior of nanofibers and their assemblies and composites is very rare. Performance of composites can be tailored for an intended application by judiciously selecting the matrix and reinforcement materials, by modifying the fiber–matrix interface, and by controlling the architecture of fibers in the matrix. Most widely used reinforcement fibers are micron size diameter fibers. There is growing need for engineered composites with enhanced structural performance in newer applications as well as existing applications, which are expected to meet higher functional requirements and enhanced safety requirements. Moreover the global movement toward sustainable development is seeking engineered materials which are environmentally benign. The electrospinning process has emerged as a viable industrial process to produce nanofibers from a variety of materials including naturally occurring polymers (3). The proposed work intend to develop novel composites based on electrospun nanofibers and to investigate their applications for enhancing the structural performance of composite materials and also to explore application of composite nanofibers in energy storage applications (4).

1. Electrospun composite nanofibers and their multifaceted applications. R. Sahi et al., *J. Mater. Chem.*, 2012,22,12953
2. Electrospun nanofibers for enhancing structural performance of composite materials.
Zucchelli A, Focarete ML, Gualandi C, Ramakrishna S. *Polymers for advanced technologies*, 2011, 22, 339
3. Nanostructured biocomposite substrates by electrospinning and electrospraying for the mineralization of osteoblasts. D Gupta, J Venugopal, S Mitra, VR Giri Dev, S Ramakrishna, *Biomaterials*, 2009, 30, 2085
4. Electrical properties of carbon nanofibers. Hedin N, Sobolev V, Zhang L, Zhu Z, Fong H, *J Mater Sci*, 2011, 462

Qualification: Ph. D in Chemistry/ Materials Science and allied fields.

Specialization: Polymeric materials (Synthesis, characterization, modifications etc.)