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Fabrication and characterization of continuous silver nanofiber/polyvinylpyrrolidone (AgNF/PVP) core-shell nanofibers using the coaxial electro-spinning process

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In the present study, continuous and uniform core-shell silver nanofiber/poly(vinyl) pyrrolidone (AgNF/PVP) nanofibers have been successfully fabricated via an efficient coaxial-spinneret electrospinning method with a vertical configuration using PVP and AgNO₃ as precursor solutions. PVP polymer was primarily used as a guide and provided an appropriate viscoelastic property by surrounding the AgNO₃ (core) solution to fabricate aligned AgNF/PVP core-shell nanofibers. A series of AgNO₃ concentrations were prepared by fixing the concentration of PVP as the shell fluid. The AgNO₃ concentration had a significant influence on the formation of the continuous and uniform AgNF/PVP core-shell nanofiber structure and applied voltage had an effect on the formation of the compound stable Taylor cone. The (AgNF/PVP) core-shell nanofibers were formed *via* the stretching of the co-electrospinning jet and the reduction temperature for an appropriate time induced the silver nanofiber to be well aligned along the axis of the PVP-template electrospun fiber. The structure and properties of the thus obtained core-shell nanofibers were investigated thoroughly through optical microscopy (OM), transmission electron microscopy (TEM), focused ion beam (FIB), X-ray diffraction (XRD) and selected area electron diffraction (SAED). Energy dispersive spectroscopy (EDS) and X-ray photoelectron spectroscopy (XPS) were also employed to analyze the elemental composition of the core-shell nanofiber surface. On the other hand, UV-vis spectrophotometry was used to test the reduction of silver ions into metal silver. Moreover, electrical measurements were performed on the (AgNF/PVP) core-shell nanofibers, which indicated that the core-shell nanofibers became insulating due to the embedded highly conductive silver nanofibers by insulating the PVP shell. Therefore, coaxial electrospinning is a convenient and cost effective process for the fabrication of continuous and uniform (metal/polymer) core-shell nanostructure fibers.

Biography

Molla Bahiru Gebeyehu has completed his PhD from National Taiwan University of Science and Technology, in Materials Science and Engineering. Currently, he is the Teacher and Researcher in University of Gondar, Ethiopia. He has published four papers in reputed journals.

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