



Application of Nanotechnology for high performance textiles

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ABSTRACT

This paper summarizes the recent development of nanotechnology in textile areas including textile formation and textile finishing. Details on two major technical aspects, using nanosize entities and employing specific techniques to create nanosize structure inside textile materials, have been elucidated. A number of nanosize fillers and their resultant performances have been reviewed. Particularly, nanolayer assembly, a new concept of textile surface coating, has been introduced. At the end, perspectives regarding future development of nanotechnology for smart and intelligent textiles have been addressed.

Keywords: Nanotechnology, nanosize fillers, nanosize structure, nanoparticles, cellular structure

Introduction

Nanotechnology is an emerging interdisciplinary technology that has been booming in many areas during the recent decade, including materials science, mechanics, electronics, optics, medicine, plastics, energy, electronics, and aerospace. Its profound societal impact has been considered as the huge momentum to usher in a second industrial revolution.^{1,2}

The “nano” in nanotechnology comes from the Greek word “nanos” that means dwarf. Scientists use this prefix to indicate 10⁻⁹ or one-billionth. One nanometer is one-billionth meter that is about 100,000 times smaller than the diameter of a single human hair. Nanotechnology endeavors are aimed at manipulating atoms, molecules and

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nanosize particles in a precise and controlled manner in order to build materials with a fundamentally new organization and novel properties. The embryo of nanotechnology is “atomic assembly”, which was first publicly articulated in 1959 by physicist Richard Feynman. Nanotechnology is called a “bottom up” technology by which bulk materials can be built precisely in tiny building blocks, different from the traditional manufacture — “top down” technology. Therefore, resultant materials have fewer defects and higher quality.

The fundamentals of nanotechnology lie in the fact that properties of substances dramatically change when their size is reduced to the nanometer range. When a bulk material is divided into small size particles with one or more dimension