

## Scope of nanotechnology in modern textiles

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### 1. Objectives

Demonstration of the scope and the applications of Nanotechnology towards the modification and development of advanced textile fibers, yarns, fabrics, and the textile processing.

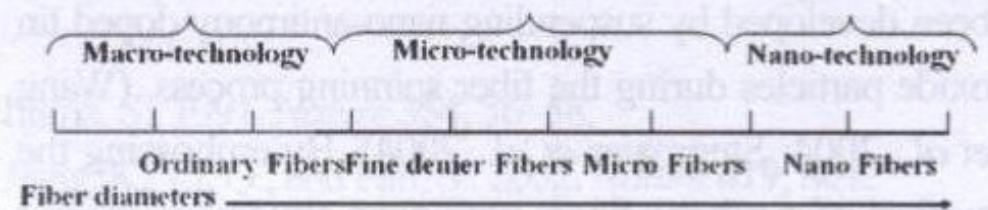
Summarize the recent advances made in nanotechnology and its applications to cotton textiles with some novel ideas and limitations of the existing technology.

### 2. Nanotechnology

Nanotechnology deals with the science and technology at dimensions of roughly 1 to 100 nanometers, although 100 nanometers presently is the practically attainable dimension for textile products and applications. The inferior properties of cotton fibers and yarns can be enhanced or complemented by engineering the physical, chemical, and surface characteristics of cotton fibers/yarns, in order to develop the desired textile attributes, such as fabric softness, durability, and breathability and the advanced performance characteristics, viz., water repellency, fire retardancy, antimicrobial resistance, etc. Enhancement of textile materials by nanotechnology is expected to become a trillion dollar industry in the next decade, with tremendous technological, economic

and ecological benefits. In recent years, the worldwide government funding for the R&D in the area of nanotechnology has increased to \$3 billion annually (Paul *et al.*, 2003).

### 3. Developments of nano-fibers/yarns



#### 3. 1. Carbon nano tube (CNT)

This high performance fiber was discovered by Iijima (1991). High-performance yarns are being produced by super-aligned arrays of carbon nanotubes (Jiang *et al.*, 2002). These fibers/yarns are produced by the electro-spinning process. The yarns strengthened with CNT exhibit extraordinary mechanical properties: Young's modulus ~TPa range, Tensile strength ~200GPa, Elastic strain ~5%, and Breaking strain ~20%. Such Nano fibers/yarns can be efficiently used as super capacitors in electronic textile components (Dalton *et al.*, 2002; Schreuder *et al.*, 2002; Dersch *et al.*, 2003; Zarkoob *et al.*, 2004; Subbiah *et al.*, 2005).

#### 3. 2. Multi-walled carbon nano tube (MWCNT)