

Nano science and technology research

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Introduction

Most of us involved with textiles recognize the tremendous progress that is being made in nano textile science and engineering over the last decade. Journal of Textile Science & Engineering (JTESE) has been promoting this important research area with papers and editorials in the past, but more needs to be done. There is a large body of textiles related nano research that is suitable and indeed encouraged by the JTESE in nano coatings and membranes for high performance clothing for example, functionalisation of nano fibres and mats, medical nano textiles such as smart dressings, slow release and others. Nanotechnology deals with the creation of functional materials, devices and systems through the control of matter at the 1–100 nm scale or to put it in context about 80,000 the size of the human hair. For the first time material scientists have the opportunity to design and engineer materials and devices by the “bottom up” so-called approach, by manipulation of matter near the atomic scale and as such having the opportunity to be in precise control of their behavior. It is therefore revolutionizing this multidisciplinary field which marries together the fundamental sciences of physics, chemistry and biology.

In the textiles arena amongst various nanostructures recently developed nanomembranes made of natural and synthetic polymers are receiving a lot of attention due to ease of fabrication and the ability of controlling compositional, structural and functional characteristics for a number of end users. Textile nano fibres have very small diameters with high surface to volume ratio, superior porosity and mechanical performance. The electro spinning of nanofibres as an example is producing a plethora of applications in many diverse fields as in tissue engineering, in biosensors, filtration, wound dressings, drug delivery and as functional coatings for high performance fabrics in clothing.

There are subfields of nanotechnology that are of great interest, let us briefly look at them:

- Nanostructures. These are materials over a nanometer in length in zero to three dimensions. Space applications such as satellites are being researched due to ease of putting them on orbit.
- Nanoparticles. It is the simplest form of a nanostructure and considered as a zero-dimensional nanoelement. Fine powders applied to cosmetics and pharmaceutical industries, ceramic coatings, fine emulsions, toners, etc. are all examples of uses of nanoparticles.
- Nanorod or nanotube. They are also nanoelements but one-dimensional with a more complex than nanoparticles construction. Nanorods are used in display technologies, where by changing their orientation with applied electric field their reflectivity is altered resulting in superior display quality. Brighter TVs known as field emission TVs have their pixels glowing better.

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Nanorod-based flexible thin film computers maybe in parts of our clothing in a few years time. Nanotubes may be used as a single molecule circuit, they miniaturize electronic components and can appear as nanodevices, and again wearable electronics in garments is an area developing fast.

- Nanoplatelets or nanodisks. They are two-dimensional elements used as construction blocks for nanodevices.
- Nanomaterials. They are the more known nano sized 1-100 nm materials being built by building blocks of atomic clusters imparting electronic, magnetic, optical or chemical characteristics. Nanofibres and mats are examples of this type. They can be designed and engineered to provide transparency, hydrophobicity, photoluminescence, toughness, hardness, sensing and biocompatibility.
- Nanocrystals. They are referred to the size of the entire crystal itself being nanosized.
- Nanophotonics. They are nano scale objects that emit light. They are also referred to as quantum dots.
- Nanomagnetics. These are known as highly miniaturized magnetic data storage materials with very high memory. The spinning of electrons for data storage is now referred to as “spintronics”.
- Nanobioengineering. The human body consists of many nanofibrous and nanoporous structures. This area is trying to functionalize molecularly the surface of an object by attaching certain molecules to it, so that it can interact with the human body in a beneficial manner such as sensing and/or filtering.
- Nanomedicine. It deals with the monitoring, repair, construction and control of human biological systems at the molecular level by the use of nanodevices and structures. Textile membranes as controlled released systems are being developed in this area.
- Nanomechanics. This area deals with the study of elastic, thermal and kinetic properties at the nanometre scale and it is very important to characterize these materials mechanically and structurally. The structural mechanics of nanotextiles interest us a great deal since some of the new preforms have to be stronger to be used for space, automotive and other industries.
- Nanofibres. This area is much closer to the textile field. These are elements that fall into the category of one-dimensional structure and may be included within nanotubes and nanorods. They can be considered as nanostructured if filled with nanoparticles or tubes. Their applications are very diverse and there is commercial machinery that can already produce a variety of nano fibre-based mats. Medical, construction, filtration and clothing are fields already using nanofibres.

The above sub-areas of nanoscience and technology are to provide a very brief overview of the many possibilities of what this new research field can bring. If authors are interested of a dedicated JTESE double issue of say a dozen of papers promoting nanotextiles please get in contact.

JTESE will continue of course to support and promote all other areas, fundamental and new that deal with advances of clothing science and technology, so original papers of high quality research are being welcomed. Vol. 11 will consist of six issues; issues one to five will contain refereed papers and the last issue six will be the now familiar and well supported research register. From the papers that are being received thus far, we will

see the creation of another exciting collection of highly original research from a truly international body of authors. The editor, the editorial board and the publishing team at Hilaris thank our authors, subscribers and referees in advance of the new volume, for their support and contributions and give to you all our best wishes.

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