

# **An Introduction to Nanoscience & Nanotechnology**

by

**G.Ali Mansoori**

University of Illinois at Chicago

[mansoori@uic.edu](mailto:mansoori@uic.edu)

## **Abstract**

In this paper we present an introduction to the principles and advances made in the fields of nanoscience and nanotechnology including inventions, discoveries and design and study of molecular building blocks (MBBs) studied through nanoscience and applied in nanotechnology. Nanoscience is the study of systems in nanoscale and nanotechnology is the ability to systematically organize and manipulate properties and behavior of matter in the atomic and molecular levels. Through nanoscience and nanotechnology it has become possible to study and create very useful functional devices, materials and systems on the 1 to 100 nanometer (one billionth of a meter) length scale.

The reasons why nanoscale has become so important are presented. Historical aspects of nanoscience and nanotechnology are introduced starting with the famous 1959 lecture by R.P. Feynman. Considering that recent inventions, discoveries and breakthroughs in atomic and molecular aspects of nanoscale systems have been quite frequent, a selected list of recent advances and future prospects familiar to the author are presented here.

## **Introduction**

Even though the scientific community is fascinated with the field of nanoscience, most of the ongoing discussions, definitions and attentions are on nanotechnology. The shortest and most quoted definition of nanotechnology is the statement by the US National Science and Technology Council (NSTC, 2000) which states: *“The essence of nanotechnology is the ability to work at the molecular level, atom by atom, to create large structures with fundamentally new molecular organization. The aim is to exploit these properties by gaining control of structures and devices at atomic, molecular, and supramolecular levels and to learn to efficiently manufacture and use these devices”*. In short nanotechnology is the ability to build micro and macro materials and products with atomic precision. Nanoscience is study of properties and behavior of condensed materials in nanoscale, study of natural nanoscale phenomena such as the fascinating field of bio-systems, and investigating the peculiarities of nanosystems (Mansoori, 2005).

The promise and essence of the nanoscale science and technology is based on the demonstrated fact that materials at the nanoscale have properties (i.e. mechanical, optical, chemical,





























