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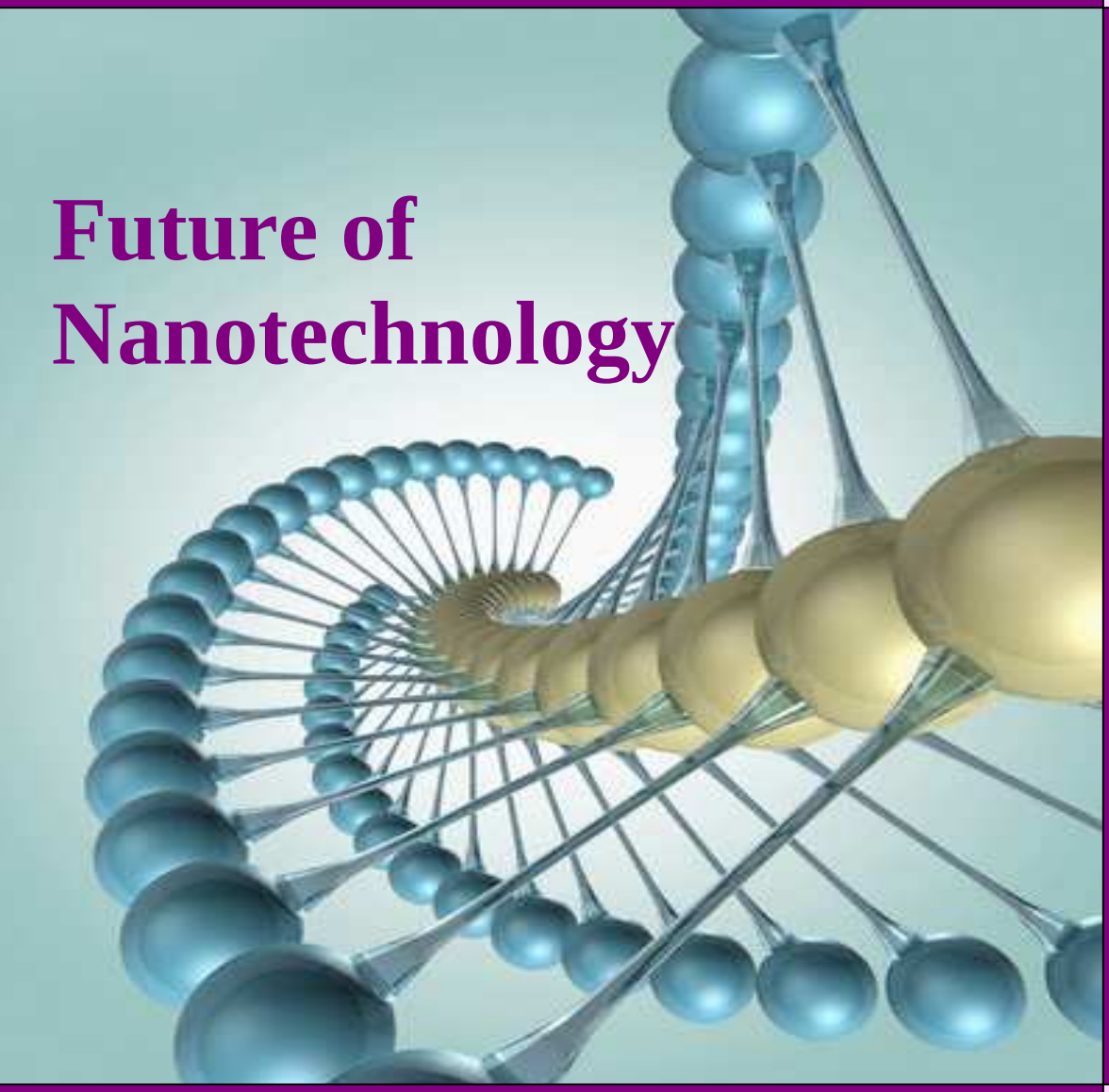
Future of Nanotechnology



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For all of the members and who are interested in Futures Studies
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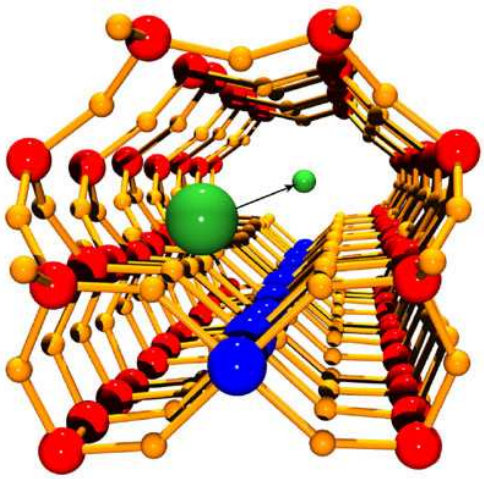
Editorial



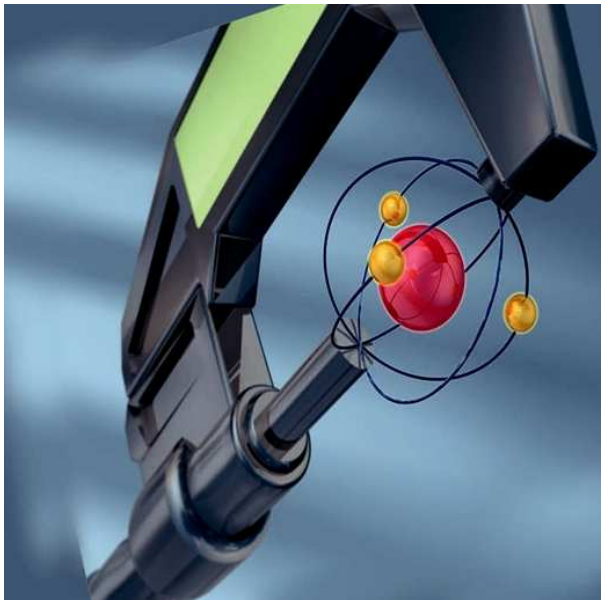
Nanotechnology is a kind of technology that is applied in a scale of one billionth of a meter or about one eight thousandth of the width of a human's single hair. It deals with atomic and molecular dimensions. Nano-scale means dimensions within 1 to 100 nanometers. (One nanometer is equal to one billionth of a meter). In fact, designing and creating structures by new arrangement in atomic and molecular levels within the scale of less than one hundred nanometer that leads to new material characteristics and performances is called nanotechnology.

Using nanotechnology in the world of emerging technologies is aimed at making new materials and products through changing or providing new substances in atomic and molecular levels. These substances are made to be used in drugs, foods, cosmetics and medical tools. Nano-materials are used to make stronger tennis rockets, anti-dirt clothes and glasses that become clean automatically. Today nanotechnology is used significantly in drug delivery and treatment, enabling the consumption of unsolvable drugs, making injective drugs as edible or breathable materials, removing drugs side effects, rapid diagnosis of diseases and treatment of deadly diseases like AIDS, Hepatitis and Cancer. In the coming future a kind of new technology in the name of "Bionanotechnology" will facilitate significant revolution in the field of medicine.

Now a serious competition is running among different countries in the field of nanotechnology and countries like South Korea and USA spend 2 to 3 and multi billions of dollars respectively for research on nanotechnology. According to the experts, nanotechnology with an age of 20 years is regarded a young technology and therefore Iran can make brilliant advances in this field. Different countries in the world spend considerable investments on nanotechnology research and development in order not to be left behind in this competition. In spite of vast changes, governments' investments and organizations' participations in the process of developing nanotechnology are not monitored appropriately. Analytical experts believe that nanotechnology is an engine of growth for 21st century.

This technology has caused quick advances in other technologies and has been applied in different fields. Market research organizations have forecasted different markets for Nano science and technology. One of these forecasts is accomplished by BCC Market research Institute and is offered as a new report titled: "Nanotechnology: A Real Market Assessment". According to this report, global market value for nanotechnology-based products will be up to US$26 billion of by 2015. According to Iranian nanotechnology experts' estimate if Iran gains %1 of nanotechnology global market, its exported nanotechnology products will have a value of US$20 billion. To realize that ideal, we should have 1 to 2 percent of global investment on nanotechnology. Within next 10 years, nanotechnology global market value will be about US$2000 billion and in the near future our country's industrial-economical life will depend significantly on nanotechnology. Considering current concerns about the future of oil exports and revenues gained from these exports usually used to manage country's affairs; investments that are made wisely to develop this technology and its related industries can play a vital role in shaping our preferred economical future.

Nanotechnology 2020 Horizon



Scientific advances in microscopy and related fields now allow us to routinely observe and manipulate materials on the atomic or molecular scale. Nanotechnology, broadly viewed, has had a profound impact in virtually every scientific discipline in the physical, chemical, and biological sciences. Given the rapid growth of the discipline and the impact nanotechnology has already had in both science and industry, it is difficult to chart exactly where advances in this technology may take us in the next 15 years.

Nonetheless, it is possible to look at advances in nanotechnology and areas of scientific advancement and see general trends that may suggest where the future of nanotechnology may lead. An increasing number of nanotechnology-enabled products have begun to appear in commercial goods. For example, sunscreens are using nanoscale particles to enhance protection from ultraviolet radiation, and nanoscale coatings for glass lenses and textiles are being used to improve wear resistance and in some cases provide added functionality.

Other commercial sectors, such as computer-integrated circuits and catalysis for chemical processing, have been using nanotechnology for many years. However, many of the advances frequently discussed in the scientific and popular literature are still only practical in research laboratories or limited to very high-end technologies. It may be years, if ever, before many of these scientific discoveries can be transferred into useful consumer goods or services. For example, *Science* published an article in December 1989 describing the design and testing of a nanoscale tunneling diode.367 While this discovery has contributed to the development of tools (e.g., scanning tunneling microscopes) and electron field emission devices, it has not replaced the semiconductor diode in integrated circuits, as some had predicted.

The transition of new and emerging nano-enabled technologies from the laboratory to commercial products is dependent on numerous factors, including integrating the device into products with characterized and reproducible properties; cost; scaling up the manufacturing or fabrication for commercial production; development of related technologies; market forces; and consumer acceptance of nano-enabled technologies. All of these factors will determine whether nanotechnologies will be able to move from the laboratory to the commercial market.

One area in which nanotechnology is uniquely positioned to enable new capabilities is sensor technology. Given that we are now able to construct devices on the size scale of individual molecules, new methods of sensing and detection have enabled unprecedented levels of sensitivity (minimum detection limit) and selectivity (ability to detect specific chemicals or processes), as well as the ability to detect processes or events that were previously undetectable. There are currently few nanotechnology-enabled sensor technologies in commercial use.

One example is Smiths Detection's (formerly Cyrano Sciences Inc.) handheld, trainable detection system that utilizes arrays of nanostructured materials in a polymer-fiber matrix to detect various chemical agents of interest. However, an increasing number of laboratories around the world are beginning to exploit advances in nanotechnology to improve chemical and biological sensor technologies.

This growth has resulted in a family of emerging nanotechnology-enabled products that, while still at various stages of laboratory and field testing, have the potential to significantly reduce the device size, amount of test sample needed, and time required for chemical and biological analyses. These sensor devices are based on various emerging nano-enabled technologies—for example, functionalized metallic nanoparticles, functionalized nanowires and nanotubes, macroscopic materials with nanoscale features or surface treatments, and nanostructured mechanical systems. All of these techniques rely on measurable changes in the fundamental properties of the material or material system as a result of interactions that are detectable by virtue of their nanoscale properties.

Notes: The Global Technology Revolution 2020, In-Depth Analysis, Richard Silberglitt, Philip S.Anton, David R. Howell, Anny Wong, RAND.