

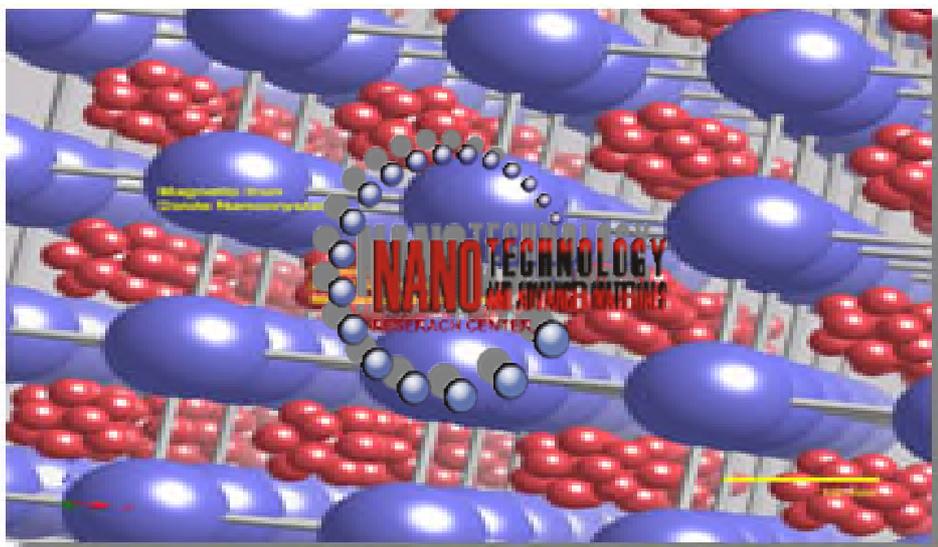


**Ministry of Higher Education & Scientific Research**

**University of Technology**

**Nanotechnology & Advanced Research Center**

**Guide of Nanotechnology &  
Advanced Research Center**



**2016-2017**

## **Word of the President of the University of Technology**

In the coming years nanotechnology will be able to replace the traditional manufacturing systems in the world to a new systems with a scientific and technological paths, and it would lead to dramatic changes in all scientific activities to create new methods of manufacturing Stuff. The employment of nanotechnology in the twenty-first century as one of the keys to economic superiority will necessitate fundamental changes in the design of production equipment and this will require new skills and strong cooperation between researchers in the physics, chemistry, biology, and engineering fields. The University of Technology and the Nanotechnology Centre of the university, undertake tasks and activities that linked with test and development and use of nanomaterials in various fields. For this purpose, it has been equipped with the latest advanced scientific instruments required by the research and development process that concerning with the nanoparticles components, to be this center the hardened core to build nanotechnology Iraqi which will be capable of dealing with the global scientific and technological developments.



**Prof. Dr. Amin Daway Thamir**  
**President of the University of Technology**

## **Word of the Vice President for Scientific Affairs**

It has become scientific and technological development a basic tributary for the progress of the industry and the economy in the world, so the big developments in the production techniques of Nanoparticles material and its diagnosis methods in recent years considered as an enormous scientific revolution in the development of production processes. So, the University of Technology was eager through the scientific effort of professors and researchers in the Nanotechnology Research and advanced materials Center to keep pace with scientific developments in this vital specialization and it is important for application the Nanotechniques in a field work. From this point on, the University of Technology has worked to unify the scientific and academic effort of the research and the applied studies in the field of postgraduate research in nanotechnology applications in specialties of engineering and scientific. On the other hand Nanotechnology Research Center has been encouraged to open up to country institutions in order to establish and build productive projects for different nanoparticles products that serve the community, and provide its marketing environment. Where this step contributes to the elimination of unemployment and the exploitation of the energy of youth and supporting the national economy.



**Assist. Prof. Dr. Alaa Abdulhasan Atiyah**

**Vice President for Scientific Affairs**



**Asst. Prof. Dr. Khalid A. Sukkar**  
Director of the Center

### **The Director of Center Words:**

Nanotechnology and Advanced Materials Research Center at the University of Technology was founded in 2009 as the first specialized center in Iraq. The center included two departments (Advanced Nanotechnology materials Dept., and Article Biomedical Nanotechnology Dept.). The Center work hard to build modern specialized scientific laboratories in the field of nanotechnology for the first time in Iraq. The Nanotechnology Center designed many programs to get the Laboratories Accreditation according to international standard ISO-17025Cutting. The Center go a long way in this area with the support of the University of Technology.

At this stage, the real scientific orientation of the center aims to intensify efforts towards practical and industrial application of nanomaterial that prepared at the center and work to solve industrial problems using nanotechnology. Therefore, center work hard to build strong scientific relationships with all institutions and universities to create real nanotechnology in Iraqi according to international standards.

## **About Center**

Nanotechnology and advanced materials research center was established in 2009 at the University of Technology in Iraq. This center aims to open lines of research that can serve applications in industry, health, manufacturing materials, high-efficiency solar cells, and sensors .Additionally, it is involved in medical, environmental, engineering and agriculture applications. The center is scientifically associated with academic research work at the Iraqi universities and with professionals and researches in other institutions through joint research teams to benefit results of Nanotechnology research activities.

### **Vision**

The vision of the center is to achieve worldwide reputation for the quality side, distinction and innovation of its research programs that can develop the scientific basis of Iraq.

## **Mission**

The centre of nanotechnology and advanced materials promotes scientific culture and research to serve the future interests of the Iraqi society and participate in the development of scientific knowledge in the world. In addition, the center work to broadly equip researcher with values, knowledge and skills needed to enable them making meaningful contribution to the progress of the society. The center is working to develop dynamic integrative programs to provide high quality academic training, research and intellectual development.

## **Objectives**

- Supporting the scientific research as a major resourceful mean for acquisition of knowledge.
- Networking with Iraqi society and worldwide to exchange scientific knowledge and enhancing the promotion of a scientific and research culture.
- Developing the role of technology for research and development purposes.
- Contributing effectively to the development of science, technology, health, and industry also to identify areas of national importance to encourage conducting quality research in such areas.
- Contributing to the sustainable development of science and technology.

- Establishing ridged and useful links with national and international institutions in research affairs.

## Center Departments

Research Center of Nanotechnology and Advanced Materials Includes two main departments, namely:

### **1-Department of Advanced Nanomaterials**

This Department features many Scientific and research activities through the preparations of nanomaterials, measurements and testing the produced materials which will be applied in many areas and scientific activities, including:

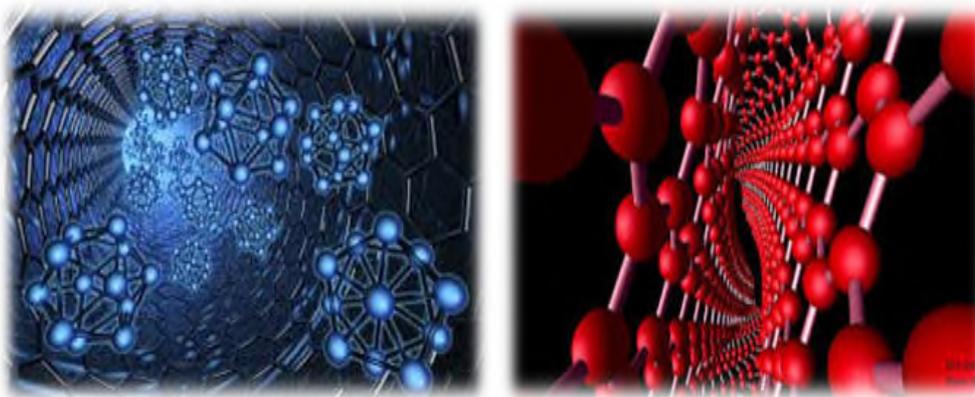
- **Nanotechnology in the field of energy**

The research teams in this activity work to develop the non-conventional energy sources via employing nanomaterials in the manufacturing processes. Scientific researches in this field Include the development of solar cells, wind power, thermoelectric materials and manufacturing high energy storage batteries as well as other researches for the manufacture of thermal insulation and efficient superconducting materials, optical sensors and optical emitters.



### ○ **Nanotechnology in the field of environment and industry**

These research groups work on in the development of optical sensors that are able to detect gases and toxic vapors and hazardous chemicals based on the interaction of chemical materials with sensor also can be used as a piezoelectric crystal in the sensing of conventional detectors in different areas, for example, analysis of agricultural, horticultural and veterinary; water and microbial contamination; clinical diagnosis and medical applications and dynamic analysis industrial gases and liquids; mining and toxic gases and explosives and military arena, and flavors, extracts and pheromones. As an example of the piezoelectric bio probe that can be used to monitor the level of pollution in the environment, including land, air and water. The sensor can also be placed for the biological monitoring of water quality through tests for contaminants and residues of chemicals, pesticides, herbicides, toxins and microbes in the water tanks.



### ○ **Nanotechnology in the field of petroleum industry**

In the area petroleum industry, the research teams are working on the development of nanoscale catalysts in applications of oil refineries as isomerization to produce fuel with high specifications. As well as the evolution of efficiency of lubrication oils for engines which operate on diesel fuel and

gasoline. Moreover, the teams work on the development and production of excavators for oil wells with high specifications using nanotechnology techniques which work in the development of nano-sensors that are able to detect gases.



- **Nanotechnology in the field of protection of pipes and equipment from corrosion**

The center includes specialized teams in the field of corrosion protection equipments, tanks, transported pipes of oil and gas using the nanotechnology techniques, as well as using protection and advanced coating methods. On the other hand, the center specializes to conduct all engineering tests for manufactured materials and raw materials to determine their suitability for various engineering applications.

- **Applications of stimulation and mathematical analysis**

The center contains a set of computers and special software packages to perform the stimulation and mathematical analysis.

## **2-Department of biomedical nanotechnology**

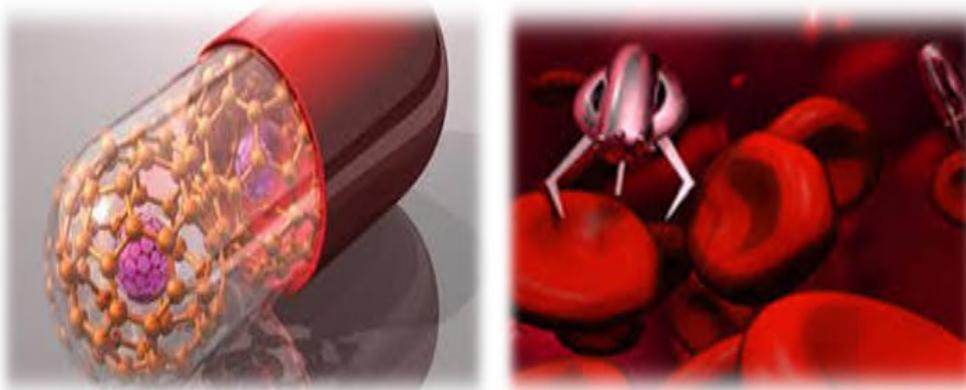
This department is concerned, which is an important branch of the of nanotechnology branches, that deals with the application of biological and biochemical biomedical. The medical applications represent the modern applications of nanotechnology among the other applications due to its direct association with the lives and health of the human being. A lot of medical

applications related to the diagnosis of specific high efficiency treatment as well as a lot of applications in the field of health care, and the most devastating diseases to humans, such as cancer.

Due to the large scientific developments in the field of medicine, the applications of nanotechnology on living organisms have become a target for many international universities and research centers to deal with. So the introduction of this section was to employ nanotechnology applications in biotechnology and medical. The research team is working on the many activities, such as:

- **Bio - Medical nanosensors**

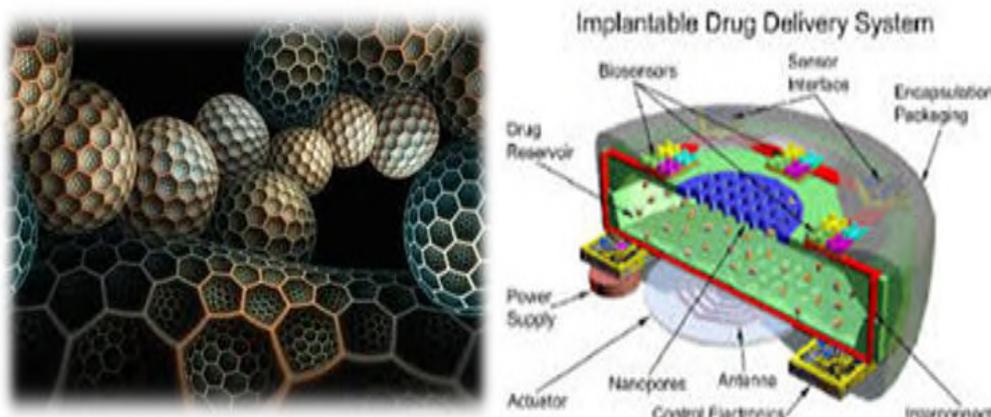
The scientific groups specialized to do applied research of interests to hospitals and medical research centers in order to solve the dilemmas techniques in the treatment of some incurable diseases. These groups manufacture nano-sensors for locating the defect in the body's organs and to provide alternatives biome that are matching the properties of living tissue from nanomaterials which are prepared at the center for these uses. They also are using nanomaterials as alternatives to antibiotics and doing applied research that aims to determine the environmental effects of nanomaterials and the study of the therapeutic effect or toxicity for different types of nanoparticles on laboratory animals to determine the health safety when applied to humans.



- **Applications of nanotechnology in drug delivery**

The team work on employing nanomaterials in the form of plankton or powders are delivered or loaded into the cells through the recruitment of proteins and nucleic acids. where, uses of the carbon nanotubes and carbon-nanoparticles balls (buckyballs) which are a ultrafine structures that deliver the drug not only for diseased tissue, but the infected cells and with great precision, any that penetrate the medication improves dramatically, They are also useful in reducing the side effects of the drug because they deal directly

with the diseased cells only and thus less side effects, which may occur from the arrival of the drug to undertake other were not intended to treat.



## Laboratories of the Center

### 1. Advanced Measurement Laboratory

This laboratory includes sets of a descriptive and diagnostic equipment to measure the nanoscale materials and structures of various forms to identify the sizes and shapes of these materials.

- Scanning Electron Microscope
- X-Ray Diffractometer
- Scanning Probe Microscope
- Optical Microscope
- Particle Size Analyzer
- Zeta Potential
- Compression Test Instrument
- Ultrasonic Test Instrument
- X-Ray Flow Detector
- Impact Resistance
- Hardness Test Instrument
- Grinding and Polishing Instrument
- Micro-Hardness Test Instrument
- GEL Electrophoresis Of Nucleic Acids
- Polymerase Chain Reaction (PCR)
- Gas Chromatography
- Spectrometer



## 2. Spectra Laboratory

This laboratory includes sets of spectral and optical equipment to measure the optical and electrical properties of nano thin films:

- Atomic Absorption Spectroscopy
- Fourier Transform Infra-Red Spectroscopy
- UV-Vis spectrophotometer
- Flame Photometer



### 3. Nano-Bio-Medical Laboratory

This laboratory includes sets of equipment dealing with microbiology in the medical and pharmaceutical fields, immune and gene therapy techniques nanoparticles and tissue engineering.

- GEL Electrophoresis Of Nucleic Acids
- Polymerase Chain Reaction (PCR)
- Laminar Air Flow
- Cool Shaker Incubator
- Spectrometer

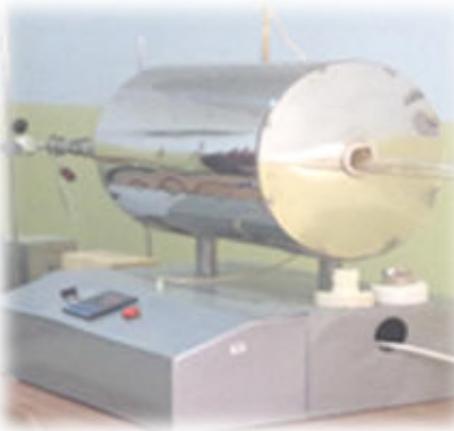


### 4. Thin Films and Coating Laboratory

This Laboratory includes sets of equipment to prepare and deposition of materials and nano-structures (thin films, powders and colloidal) in various methods (physical and chemical) to study its applications in various fields

- Electro Spinning
- C-Fiber Laser (femto-second)
- Laminar Air Flow
- Water Bath System
- Spin Coater
- Physical Vapor Deposition System
- Pulse Laser Deposition/ Ablation Systems

- Chemical Vapor Deposition System
- High temperature and Muffle



## **Safety of Nanotechnology**



Despite the positive aspects of nanotechnology that can carry for the future, the development and facilitation of life, but there are many experts who believe that the use of this technique in certain areas of life may have undesirable consequences.

Nanotechnology Based on miniaturize the size equal to one billionth of a meter, and then use the new material in multiple products and industries. Traditional sciences such as physics and chemistry do not deal with these sizes, even a research and study resort to quantum mechanics as type of interpretation .

The environment and global health organizations in allover the world held conferences to discuss the risks that may result from the use of nanotechnology. last year, the first global meeting was organized in Brussels to discuss nanotechnology damage. The Nanotechnology double-edged sword, Despite of its advantages but also the potential risks because of the impact of nanomaterials on human health may also consider.



Nano-particles have the ability to enter easily into the human body through the pores without any resistance and can spread within the body. You can imagine that the particle size of 300 nm can access easily in the human body cells and the particle size of 70 nm can enter with ease in the nucleus cell. this may show the great danger that possible be exposed by human. The interaction between the nanoparticles and cells of the human body may happen and lead to poison the cell or change the properties that lead to death . many studies conducted on animals have shown that when exposed nanoparticles enter to the body and accumulate in the brain and blood cells, nerves, this means that the nanoparticles are destructive materials to human body. some scientists showed fear that nanotechnology will lead mankind to a long road full of physical and Health problems.