



**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**INTERNATIONAL MATERIALS ASSESSMENT  
AND  
APPLICATION CENTRE (IMAAC)**

*IN COOPERATION WITH*

**COMMITTEE FOR SCIENCE AT THE COUNCIL OF MINISTERS  
AND  
NATIONAL ACADEMY OF SCIENCES  
OF THE REPUBLIC OF BELARUS**

## **AIDE-MEMOIRE**

**Expert Group Meeting  
On  
Nanotechnology**

**10-12 November 2003, Minsk, Republic of Belarus**

**2003**

## *I. Background*

Nanotechnology is the application of science to developing new materials and processes by manipulating molecular and atomic particles. "Nano" derived from the Greek word for small. Used to indicate one-billionth or  $10^{-9}$  power. Since an atom is roughly 10 nanometers, the term has come to be applied to general study of molecular and atomic particles.

Today, we are at a very exciting stage of the development of nanotechnology industry. Nanotechnology is following a very similar path to that of biotechnology after DNA was first successfully spliced. Many prudent companies are beginning to notice the impressive rate at which nanotechnology is progressing. Like biotechnology was 25 years ago, nanotechnology is now poised for extremely rapid growth.

Today the word "nanotechnology" is used in two very different ways:

- 1) Near-term nanotechnology: Industry today uses the term to cover almost any technology significantly smaller than microtechnology, e.g. nanoparticles. These new products will have positive and negative health and environmental effects which should be studied, but their societal effects-both positive and negative-will be modest compared to later stages of the technology.
- 2) Advanced nanotechnology: Technology enabling broad control at the level of individual atoms. The essence of nanotechnology is the ability to work at the molecular level to create large structures with fundamentally new molecular organization. It is this stage of nanotechnology, which will have major societal impact, and the Expert Group Meeting will focus here.

Advanced nanotechnology, known as molecular manufacturing, will give the ability to construct a wide range of large objects inexpensively and with atomic precision. It will take us beyond materials and devices to complex systems of molecular machines, inspired by-but in some ways superior to-those found in nature.

Molecular manufacturing systems can be envisioned as factories operating at the nanometer level, including nanoscale conveyor belts and robotic arms bringing molecular parts together precisely, bonding them to form products with every atom in a precise, designed location.

It is important not to minimize the technical challenge of such a complex systems engineering project. Indeed, new tools must be developed before beginning a direct attack on the problem. Nonetheless, ongoing research is building the needed technology base and will eventually place enormous payoffs within reach.

Gaining molecular-level control over the structure of matter will bring a wide variety of positive applications:

- **Medical uses:** Molecular machine systems will be able to sense and rearrange patterns of molecules in the human body, providing the tools needed to bring about a state of health, regardless of a disease's cause.

- **Environmental applications:** Using molecular manufacturing techniques, it will be possible to construct our products with zero chemical pollution, recycling leftover molecules. Environmental restoration could be carried out at the molecular level, detecting and inactivating unwanted chemicals.
- **Energy uses:** The new knowledge of electrons movement mechanism in the condensed matter will allow to make a giant jump in nanoindustrial revolution. It will create an opportunity of transition to solid-state energy-efficient and environmentally acceptable power engineering - NanoPowerEngineering.
- **Raising sustainable living standards:** Molecular manufacturing will be able to cleanly and inexpensively produce high-quality products using common materials (especially carbon, which is in excess in the atmosphere in the form of carbon dioxide) and solar energy.
- **Low cost to access to space:** The strong, lightweight materials enabled by molecular manufacturing will greatly lower the cost of access to space and space resources, making their active use affordable for the first time.

These benefits should be attainable though the combined results of (1) a well-funded R&D program, (2) private sector efforts to bring down costs, and (3) public policy aimed at explanations for positive and negative sides of molecular manufacturing.

At the same time, it is acknowledged that the application of new technologies brings usually both benefits and problems. In this regard, it is expected that advanced nanotechnologies may bring problems of several sorts mainly due to lack of information and access. For instance, excessive or incorrect patenting of fundamental machine parts at the nanoscale may reduce commercial competition and make molecular manufacturing products too expensive for many to benefit. But these problems may be solved through proper policy in patenting and protection of intellectual property, education and training.

**The International Materials Assessment and Application Centre (IMAAC)** is being established by UNIDO with support from the Government of Brazil and located in Rio de Janeiro. Its mission is to provide an international forum to serve the materials community for more effective management of the techno-economic aspects of utilization of traditional and new materials and to assist the developing economies to absorb and apply rapidly emerging knowledge of materials to enable them to cope with the demands of competitive global markets as well as meet quality and environmental standards.

The main objective of IMAAC is to address the issues of materials technology having a major trans-sectoral impact on economic growth and competitiveness and foster sustainable development of materials sector of industry that would lead to major qualitative changes in the production cycle – from processing of raw materials to obtaining of finished products.

In this context, IMAAC and other UNIDO International Technology Centres (ITCs) are well equipped and placed to play an important role in supporting this process at a country level by assisting in technology sourcing, assessing a new technology and bringing best

international practices and experience in its application in the industrial sector, thus contributing to the process of sustainable development.

Their main mission is to bridge technology divide faced by the developing countries through establishing an international framework and mechanisms for technology roadmapping. They will have to play the role as a cornerstone of the innovation systems and a bridge between the macro and micro levels. They have also to be active agents of innovation and technology transfer (North-South and South-South) with networking arrangements and strategic alliances between public and private sectors, research community and industry.

## ***II. Objectives***

- To discuss the basic areas of application of nanotechnology.
- To review the experience of selected industrialized and developing countries in application of these new technologies, principles in the development of industrial sectors and new products and formulation and implementation of relevant technology policy.
- To introduce UNIDO/IMAAC technology roadmapping programme and discuss the areas and modality of its implementation in the area of nanotechnology.
- To outline possible programme of international cooperation in that emerging sector of industry, define the role of international organizations, identify possible sources of funding for such a programme and define the funds mobilization strategy.
- To work out the recommendations and measures to further promote and implement this programme in the materials sectors of industry.

## ***III. Preliminary Programme***

The Expert Group Meeting will be held on 10-12 November 2003. The provisional programme will consist of the following main elements:

### **10 November 2003 (Monday)**

- Introduction of the participants, approval of the agenda and chairperson.
- Presentation on main technological achievements in the area of nanotechnology and future trends in the developments. Discussion on these issues.
- Presentations of the participants about the experience of their countries in nanotechnology and applications in specific industrial sectors.
- Review of experience of selected countries and discussion on the issues.

### **11 November (Tuesday)**

- Introduction of UNIDO/IMAAC materials technology promotion and roadmapping programmes and discussion on the areas and modality of its implementation in this emerging materials sector.

- Identification of possible areas of international cooperation and sources of funding to implement such a programme. Discussion on the funds mobilization strategy.
- Working out the recommendations and measures to further promote and implement this programme in the materials sectors of industry.

#### **12 November (Wednesday)**

- Introduction of UNIDO/IMAAC materials technology promotion and roadmapping programmes and discussion on the areas and modality of its implementation in this emerging materials sector.
- Identification of possible areas of international cooperation and sources of funding to implement such a programme. Discussion on the funds mobilization strategy.
- Working out the recommendations and measures to further promote and implement this programme in the materials sectors of industry.
- Summing up and closing session.

#### ***IV. Participation***

Participants will be the specialists in materials science and engineering with expertise in nanotechnology, technology and industrial policy from government organizations, academia and UNIDO who have the knowledge and experience in industrial development and technology policy formulation. In particular, they will be from Brazil, Egypt, India, the People's Republic of China, UK, Japan, Republic of Korea, Italy, Austria, Republic of Belarus, Russian Federation and Ukraine.

#### ***V. Documentation***

The main documentation will consist of presentations on basic and specific elements of technology roadmapping and experience of the participating countries in this area, including sectoral programme development and formulation and implementation of relevant technology and industrial policy. The presentations will be distributed among the participants of the EGM and included in the final report of the meeting.

#### ***VI. Language***

The Meeting will be conducted in English.

#### ***VII. Location***

The Expert Group Meeting will be held in Minsk, Republic of Belarus. The participants will be informed about the exact premises later on.

#### ***VIII. Financial and Administrative Arrangements***

The UNIDO/IMAAC will cover the travel cost via the most direct and economic route and pay DSA (daily subsistence allowances) and small honorarium for invited experts.

The participants will be responsible for travel and all other expenses incurred in the home country incidental to travel abroad, passports, visas, the required medical examinations, inoculations and other such miscellaneous items, as well as internal travel to and from the airport of departure in the home country.

***IX. UNIDO and the host country will not assume any responsibility for the following expenditures, which may be incurred by participants:***

- (a) Compensation for salary and any related allowance during the period of meeting.
- (b) Travel and any other costs incurred by dependents.
- (c) Costs incurred in respect of travel and accident insurance, as well as medical and hospitalization bills in connection with attendance at the meeting.
- (d) Compensation in the event of death, disability or illness.
- (e) Loss or damage to personal property while attending the meeting.
- (f) Purchase of personal belongings and compensation in the event of damage caused to them by climatic or other conditions.
- (g) Other unforeseen.

***X. Contact Persons***

**All communications regarding the Expert Group Meeting should be addressed to:**

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