

## Preface

This book presents the proceedings of the NATO Advanced Research Workshop (ARW) ‘Nanomaterials and nanodevices for Ecological Security’. The ARW was held in Jurmala, Riga, Latvia from June 20 to 24, 2011 and brought together scientists from USA, Germany, Spain, Italy, Israel, Belgium, Japan, India, Finland, Poland, Slovak Republic, Latvia, Lithuania, Ukraine, Russia, Belarus, Uzbekistan. The Workshop has provided the possibility to the leading experts from NATO and NATO-Partner countries to identify and to discuss the key theoretical, experimental and utility issues related to the creation of novel nanoscale devices that will ensure a significant increase in ecological security.

A part of the presented lectures are devoted to the application of nanomaterials for the creation of novel nanodevices and sensor systems for prevention of technogenic and ecological catastrophes. Multifunctional applications of these nanodevices were considered in the key lectures. The ARW participants discussed the relevant scientific and technological problems including fundamental problems of organic-inorganic hybrids improvement and their application in the creation of novel nanodevices. The innovative approaches to the creation of biosensors for detecting pathogenic microorganisms with radically lowered measurements time and detection limits were a subject of the key lectures. Some lectures were dedicated to the problems of radiation modification of nanomaterials, on the one hand, and to the defence against the radiation danger, on the other hand.

The existing major problems concerning further advancement of nanotechnologies were also considered. Unexpected obstacles in the creation of novel nanodevices that had been revealed in the past were a subject of intensive discussions among the participants. In particular, one of such problems dealt with the nature of electronic noise in deeply scaled nanodevices. This problem is closely connected with the creation of the efficient lower-powered devices, including new sensor systems. A critical factor that puts on the further progress in nanotechnologies is the slowing speed of signal propagation within the chip. New approaches to the creation of nanomaterials that can ensure progress in the solution of chip interconnect problems were presented.

Novel nanodevices connected with a new direction of electronics – “track electronics” – were considered from the point of view of the creation of new generation of electronic systems. They open a unique possibility to study mechanisms of nanoparticles/bio-objects interactions at the atomic and nanoparticle levels and to get the precise dose dependences of the nanoparticles interaction with bio-systems. The ion track-based structures form a principally new foundation for interfacing conventional electronics with bio-active sensor compounds. Novel electronic devices exhibit multifunctional properties. As a rule, they are influenced by ambient physical or chemical parameters and, therefore, act as sensors with new promising properties.

The NATO ARW has succeeded in the effort to expand collaboration and the exchange of knowledge between Western and Eastern scientific communities and has spawned collaboration agreements and programs.

According to the program of the Workshop, the presented lectures are divided in two parts:

- Nanomaterials
- Nanodevices.

In its turn, each of these parts includes three subsections:

- Fundamental theoretical models
- Experimental approaches and results
- Present practical applications and future perspectives.

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