

STATE-OF-THE-ART IN ICT APPLICATIONS FOR NANOMATERIALS AND TECHNOLOGIES OF NANOMATERIALS EDUCATION

Prof. S.I. Sidorenko, Prof. S.M. Voloshko, Ing. G.D. Kholmska

*Metal Physics Department, National Technical University of Ukraine
"Kyiv Polytechnic Institute", 37, prospekt Peremohy, Kyiv, 03056, Ukraine,*

Email: sidorenko@uap.ntu-kpi.kiev.ua

Research and development in nanomaterials and technologies of nanomaterials involves manipulating and controlling individual atoms and molecules to model, simulate, design and create new materials, nano-machines, and nano-devices for application in all aspects of our lives. This branch belongs to that where strong academic background of researchers and engineers, new ideas and intellectual efforts are the most crucial factors of the overall success of innovations.

To prepare future professionals for emerging opportunities in nanomaterials and technologies of nanomaterials academic communities shall provide students an interdisciplinary education to with a broad understanding of natural, engineering and information sciences, develop methodology for integrating nanomaterials and technologies of nanomaterials education into mainstream curricula as well as offer programs for refresher training to specialists and instructors.

Research university's strategies for teaching should be based on creating both knowledge-centered and learning-centered environments inside and outside a classroom. Because technologies are advancing so fast, activities that encourage creative thinking and life-long learning should be given the highest priority. Research universities should offer a rich environment where education and research are blended in the complex process of mind forming.

All above-listed problems can't be solved without wide usage of ICT. As well as distant forms of education. National Science Foundation (USA) estimated that by the year 2015 there will be a need for 2 million workers worldwide in the fields of nanoscience and nanotechnology. According to Academician Y.D.Tretiakov this number is higher – about 5-6 millions.

This “army” needs to be given second education or to be provided with advanced training that can't be implemented in such volume without distant forms of education. But also “first education” that physician students, material scientists etc. will get today in universities in the field of nanomaterials and technologies of nanomaterials can't be provided without ICT, without Internet-resources, without electronic libraries.

The presentation gives an overview of ICT (information and communication technologies) applications which can be used effectively both for education (and for research activities) in nanomaterials and technologies of nanomaterials in different countries and world regions.

Now powerful Nanotechnology Infrastructure Networks in different countries between university-based laboratories, research and business centers provide interdisciplinary, hands-on environment for students, scientists and engineers, discoverers and inventors, that enable them to come together and use simple and complex instruments of nanotechnology to bring their ideas to fruition.

For example, gateway to USA National Nanotechnology Infrastructure Network (NNIN) is National Nanotechnology Initiative (NNI) is given by web-portal <http://www.nano.gov/index.html>

The portal serves as technical basis of collecting educational resource, distributing the best pedagogic practice. All NNIN educational materials are accessible via the web at education.nnin.org.

Asia Nano Forum Network Organizations

<http://www.asia-nano.org/index.php>

unites research and educational resources of Australia, China, Honk-Kong, India, Indonesia, Japan, Malaysia, Newzeeland, Singapore, South Korea, Taiwan, Thailand, Vietnam countries.

European Nanotechnology Gateway – <http://www.nanoforum.org/>, Russian Federation's Internet-Portal “Nanomaterials and Nanotechnologies” based on Moscow State University – www.nanometer.ru, Ukraine's (National Academy of Science of Ukraine) – http://www.imp.kiev.ua/NANO/Eng/main_eng.html.

21st International CODATA Conference

All these Internet-resources are commonly used in practice of Metal Physics Department's educational activities.

Some proposals are addressed from NTUU "KPI" Metal Physics Department in the field of ICT innovation for education:

- electronic textbooks "Structure of Liquid, Amorphous and Crystalline Materials" and "Physics for Engineers"; distant course "Thermodynamics and Kinetics of Diffusion in Solids"; multimedia «Master Case for Speciality "Physical Material Science"»; the Model of Virtual Information Space of Metal Physics Department of NTUU "KPI" – "PhysMetNet", – that are practically ready for industrial production and market realization (business – plan may be proposed, but marketing is necessary);

- developing ICT applications in education of Physical Material Science (including education in nanomaterials and technologies of nanomaterials): bio-compatible metallic materials, metallic materials for medicine;

- creating (with Metal Physics Department of NTUU "KPI", Ukraine) the VILEMAN (Virtual International Laboratory in Electron Microscopy for Advanced Nanomaterials) as the mechanism of "quick responses" to challenging "industrial questions" in nanomaterials and technologies of nanomaterials and also as the "place" where new knowledge is produced and delivered by means of ICT (VILEMAN International project for universities-members of Black Sea Universities Network – will be represented in our other report).