Some Perspective Aspects of Nanotechnology Development

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Abstract – **stages of formation and some perspective aspects of nanotechnology development, in particular, nanoelectronics and getting nanomaterials is analyzed in this report.**

Keywords – **Nanoelectronics, Synthesis of nanostructure, Electronic and ion lithographic, thin tapes, Micro-mechanisms**

INTRODUCTION

Nanoelectronics is leading direction in nanotechnology development. Informational technologies based on application of nanoelectronic communication systems, information processing and registration systems, intellectual manufacturing processes, transport, medical and everyday devises and systems control develop rapidly.

Solving of energetic and ecological problems requires manufacturing of new catalysts, gas absorbers and separators, molecular nets, electrodes and membranes for new renewable energy sources and transformers and its control with the help of nanoelectronic devices saturated with nanoelectronic elements, sensors and mechanisms that will be more and more useful.

It is very important that considerable resources, thought out organization of personnel education, organization of scientific researches and introduction of results into manufacture are necessary for nanotechnology development.

WHAT NANOTECHNOLOGY AND NANOSCIENCE ARE?

Nanotechnology should be called totality of getting functional elements, systems and nanomaterials with dimensions of separate components that can be compared with molecule dimensions that are equal 100-200 nanometers methods.

Nanoscience studies processes that flow in very small nanodevices with visualization and measuring, with computer modeling of the processes, with control of manipulation of separate atoms and molecules. Introduction into manufacture of nanosized components and systems is also very important.

There are two main methods of nanocomponents and structures creation: a) *from bottom to the top* with application of separate atoms manipulation or by using their natural tendency to group in clusters that is very important in creating nanomaterials and b) *top-down* mainly after application and perfection of methods developed for manufacturing submicron electronic elements and systems. It should be mentioned that only combination of these two methods can solve problems of nanotechnology.

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STAGES OF NANTECHNOLOGY DEVELOPMENT

80s of 20th century are known to be the beginning of nanotechnology development. In these years several discoveries and achievements of scientists from different countries took Nobel award: such as R. Carl and H. Krotto (1996) for synthesis in 1985 from carbon atoms of nanostructure called fullerene;

B.G. Binning and H. Roher in Zurich created scanning tunnel microscope (STM, AFM); Holland and Britain physicists observe stairs on vault-ampere characteristics of point contact (1987) approving effect of quantum conductivity; T.A. Fulton and G.J. Dolan in Bell laboratory construct one-electron transistor and observe coulomb blocking; scientists from USA, France and Germany discover effect called giant magneto-conductivity at the same time (1984-1987); Sumio Ijima (1991) attracted world interest to carbon nanotubes that he developed; in 80s and 90s main results in electronic and ion lithography field were published; at the same time role of molecule self organization on metal surfaces started to increase; since 1996 some state agencies in USA have started researches of world tendency of nanoresearches and nanoworks for industry and researches of recommendation to USA government to exceed resources integrated in this field.

SOME FEATURES OF THE MATERIALS THAT WERE GOT WITH APPLICATION OF NANOTECHNOLOGIES

For *material* to get new properties and gtt new applications *appropriate nanostructure must be synthesized*. It is connected to typical length, correspondent to each material feature. For example, electric resistance of the following material is result of dispersion of electron flow situated in conductive zone, due to the hits with vibrating atoms of the material and its admixtures. These acts of dispersion characterize by length called free run (or dispersion length). When device length becomes comparative to one or another characteristic length (most of them are situated in nanodimensional field) physical and chemistry of this effect changes.

Moving power of nanotechnology is search of nanomaterials with structure and features that differs from big characteristics of materials (what is actual for most materials) and creation of devices based on nanodimensional components created on the base on regularity that is actual in nano-world.

It is forecasted that the fastest development will be: nanoelectronics and devices connected to information technologies; technologies that collect and effectively transform energy; biotechnologies that increase quality of life and technologies that improves ecology and not on the last place – nanotechnologies.

NEW FEATURES OF NANODIMENSIONAL MECHANICAL STRUCTURES

Thickness of this tapes influence on its color (if they are opaque for light) and is function of the thickness. This effect is perspective for research and creation new surfaces with new features.

Chemical reactions between hardly crushed materials differ from the same reactions for less crushed materials. For example iron and aluminum powders with micron or nanodimensional particles self ignite if they are stored in air. Another example is in nanodimensional field melting temperature of gold is less than melting temperature for the same big material. Surface and interface layers with micron and nanodimensional particles also differ in properties. For example thickness of surface layer, where electronic features are determinant, is 0,1 nanometers thick for metals and up to 0,01 nanometers (1 micron) for semiconductors. Accordingly, optical, magnetic features of the materials change. Quantum dimensional effects are connected to quantum of quasi-pulse with spin condition of electrons and core etc. Surface layers and quantum dimensional effects in thin tapes are connected to wave size of electrons and observed in semiconductors with big thickness more than in metals.

Between two metal surfaces that have small distance from each other there is unknown in macro world power – power of H. Casimir (it was founded in 1948). This power is interesting to designers of micromachines and nanomechanisms and to theorists that study structure of physical vacuum.

Lithographic technologies and deep etching of microstructures is perspective to use for getting micro-mechanical, microoptical and electromechanical devices. For example for microdevices Fresnel zone lens microengraved in cross selection of optical fiber. And micro-toothed wheels with toothed rail from silicon are gotten with micro electronic technology. They are for electromechanical executive mechanism. Mechanical characteristics of turned out to be suitable for transition of efforts in micromechanisms; it is perspectively to get thin mechanical membranes, tubes with small diameters (fluids that go through them have strict determined velocities or temperatures). It is possible to have additional ploy and microstructure of thin conductive or dielectric tapes and structures of sandwich type. Also it is possible to have new method of sensors construction and executing elements with micro- and nanodimensions.

MAIN TENDENCIES OF SOME NANOTECHNOLOGIES DEVELOPMENT. CONCLUSION

Perspectives and grounded forecast of development of some nanotechnologies for the next ten years are described in the report. Some main branches of using nanotechnologies are given. It is firstly in semiconductor sensors based on carbon tubes, parts for atomic microscopes, new types of displays (OLED – organic light- nanoelectronics: new types of memory (electronic and emitting diode, displays with pole emission from quantum points, with carbon tubes etc.). Unfortunately in East Europe material base, staff education and organization of nanotechnological researches do not satisfy appropriate level that leading countries had 10-20 years ago. Actual problem becomes creation of condition for preparation of next generation of young skilled workers. If we lose the best genetic material (young specialists that studies in Europe and American countries, and those young scientists who left because of better propostions) than our lag in future is inevitable. Not only our, but all countries need strategic cooperation in researches and manufacture. Only with the help of mobilization of staff potential and wise using of sources our countries can compete in international work division. If we take part in research and development of nanotechnology process we will be able to get right to our own manufacture. That is why development of nanotechnology is one common aim of our countries.

REFERENCES

[1] Младенов Г., Иновацийте и новите приложения на електроннолъчевите технологии взаимно се стимулират, ЕЛЕКТРОНИКА’2006 - Доклади, стр.17-20, Изд. СЕЕС, София, 2006 г.

[2] Младенов Г., Нанотехнологии и наноелектроника - Бъдещето започва днес, ЕЛЕКТРОНИКА’2008- Доклади, стр.9-14, Изд. СЕЕС, София, 2008 г.

[3] Попов А., Полупроводникови материали за наноелектрониката, Унивеситетско издателство, София, 2007 г.

[4] Велчев Н. Наноелектроника, Унивеситетско издателство, София, 2008 г.

[5] Младенов Г.М. Електронни и йонни технологии. Акад.изд. М.Дринов, София, 2009 г.

[6] Високов Г, Недков И. Същност и приложение на наноматериалите и нанотехнологиите. Списание на БАН, кн.6, стр.22-34 , 2008 г.

[7]Младенов Г.М., Нанотехнологии и наноелектроника Акад. изд. М. Дринов, София, 2009 г.