Nano Technology Conference

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Information technology and telecommunications have ever been playing a leading role at the introduction of earlier new technologies, which allowed us to think that we must take again a major part in the proliferation of this new technology. With this concept in mind, the International Council for Communications and Information Technology (NHIT) and PKI Telecommunications Development Institute (PKI) have teamed up to deliver an overview of the development stage of this technology and the perspectives it promises for the different sciences.

It was just ten years ago that the first publications were being issued on the nano technology subject. The importance of this field was then far from obvious. But since the turn of millennium, the number of the application fields of this science is growing constantly. It is now clearly recognized that this cannot be regarded as an advanced branch of microelectronics.

In fact, in the micrometer order of magnitude, the fundamental material units remain unchanged and the different devices scaled in the micrometer range are based on the macro metric behaviour of the material. Although the last thirty years have seen the permanent decrease of the dimensions to achieve by now a few micrometers for the individual devices and a fraction of them for the wiring itself, this decrease has not entailed any fundamental changes. Manipulations ranging down to the order of magnitude of nanometers are already piercing into the interior of the cells and molecules, altering the crystalline structure and the internal links. This also spells the modification of the characteristics of the material.

Early 2003 we started to make arrangements for the establishment of an "educational" conference. It came shortly to light that we could not have a leading role in this process, as physicians, chemists and technologists had already unveiled actual results in this field.

We gradually became acquainted with the research nodes where significant experiences had been accumulated. Ranked first among them are the different institutes of the Hungarian Academy of Sciences, but we have been working intensively also at several universities to not only research this field but also to transfer learning about this subject. Thus we deemed necessary to get together a more general organizational team. The members of it are *József Gyulai* (HAS Research Institute for Technical Physics and Material Science), *Pál Bárczy* (Miskolc University, Institute for Material Science), *Zsuzsanna Mokry* (Ministry for Education), *Miklós Zrínyi* (Budapest University of Technology and Economics, Department of Chemical Engineering), *Sándor Imre* (BUTE, Department of Electrical Engineering), *Tamás Roska* (Péter Pázmány Catholic University and HAS, Computer and Automation Research Institute). We succeeded in getting the patronage of *Norbert Kroó* (Secretary of HAS), *Elek Straub* (Chairman-Chief Executive Officer of Matáv Rt.) and *László Pap* (Vice-Rector of BUTE).

The members of the organizational team undertook to set up a section for each field. These efforts have borne their fruit, as the initially half-day conference evolved gradually to a whole-day, then to a one and a half day, and finally to a two-day seminar with professional lectures read all over the time. Late 2003, being knowledgeable about the program, we concluded to organize the conference from 26 to 27 April, 2004. On the first day, the Hall of the Academy, on the second, the Tölösi Hall of Matáv Rt. Headquarters have been the locations where the audience of more than 200 could benefit from the lectures. The two co-chairmen of the conference have been *Ernő Simonyi* (NHIT) and *Vilmos Koralewsky* (PKI).

Now let us recite some eminent results of the conference. While doing this, we will commemorate some lectures in more details, and the others in brief. This proceeding may however not be deemed a value judgement, as all lectures presented a high professional degree and were delivering valuable results to contribute to the development of the nano science. The sequence of the themes is defined rather by our opinion which point we are stressing, which results may present themselves with innovative solutions to have a widespread use. The representation of all these achievements serves our goal to suggest that the nano technology is not an abstract science anymore, a scientist's toy, but a tool that can be used in numerous areas for the solution of emerging problems and the enhancement of classical methods.

The first results of the nano technology have been the carbonic nano tubes. Simultaneously, such measuring instruments and manipulators have been made that were able to perform the tasks in the nano range. An eminently attractive solution has been the application of the laser beam as a clip and as a motor driving tool. These "light-(laser)made and -operated devices" have been referred to by *Pál Ormos* (Szeged). The results have been quite surprising, and it has been shown which innovative tools completely different from their predecessors are able to solve specific tasks in the ranges invisible to the naked eye and hitherto unmanageable by any known devices. The HAS research institutes have also informed the audience on a great number of novelties. We also heard a report on the definition of high-resolution surfaces, on the creation of new material features and also on the formation of structures with required characteristics. The HAS Technical Development Funds have been represented by *József Gyulai*, academic, who held an introduction into the basics, and it has been clearly testified that in Hungary there exists an institute that can solve the emerging tasks by means of tools of the nano technology. HAS, itself, has been carrying out in-depth researches into the possibilities of GaAs/Au compounds so highly relevant in telecommunications *(Imre Mojzes)*.

Biological applications are also spreading out towards divers facilities. Let us just start with the statement, that we can control the aging processes on the basis of the approach from the nano technology, thus restricting the complaints and disabilities of the elderly to an acceptable level *(László Iván,* Semmelweis University). *László Lázár,* from the Hospital of Nyíregyháza, exposed, that backbone operations that had been regarded several years ago extremely hazardous and capital, could be radically changed. By exploring the problems by means of the tools of nano technology and by designing and manufacturing the necessary prosthesis for the healing in advance, they perform the operations using a minimum of cuts. As soon as 2 to 3 days after the op the patients are released from the hospital. In the biological section, researchers of the Biological Research Institute of Szeged published their experiences in gene technology and nano technology of bacteriology. Gene technology, through manipulating the DNS chips on animals, communicated quite surprising results. Although these have been advantageous in many instances both for the animal and for the progeny, we have concerns whether the human gene modification could be ethically acceptable.

In the section of nano-structured industrial materials, the practically most amazing lecture has been held on the utilization of nano-magnetism for measuring inequalities above rails. After this, the grinding can be performed at the minimum material loss. The measuring results can control the grinder at a precision of the nanometric range. The successive representations have focused on the details of influencing the characteristics of ceramics and metals by means of tools of nano technology. This facilitates both increasing their solidity and modifying the surface hardness, but polymeric composites can also be produced. The universities of Debrecen, Miskolc and Budapest and also the Zoltán Bay Institute have equally proven their skills in producing new materials of nano-structure, fulfilling specific needs.

The Section IV put prominently those fields into the foreground, where Hungarian researchers discovered solutions recognized as world-class innovations. They

spotlighted also a domain holding out much more promises for electronics than ever. By conceptually upgrading nano-structured silicon, these researchers succeeded in locating such applications that are not only smaller but also much more diversified than the previous silicon-based semiconductor solutions. In this section, prominent domestic achievements of manufacturing nano-structured alumino-silicates and metals have also been presented.

Nano technology has unveiled novel solutions for encryption and data protection in the fields of telecommunications and information technology. *Michele Mosca* of Canada recited the security to be achieved based on the quantum algorithm theory and its implementation. It was accompanied by an exposition on quantum cryptography that related the information elements to a photon. It has intended to realize security by the features of the photon, but its practical use is deemed to require further investigations.

The team of *Tamás Roska* (Péter Pázmány Catholic University) has summarized three terrains of nano technology (Nano Bio Info Cogno). By detecting the bioelectrical signals of cerebral processes, it is possible to control directly by thoughts diverse technical operations, machines or any other biological systems. This field is a promising area, with the results presented being near to be handled as a reality, all the same we are accustomed to take such ideas as science fiction. We were however astonished as we could learn from the studies of *György Karmos* and *István Ulbert* that this concept is already a reality. We had equally the sense of some futurology as we heard of the self-organizing nano systems, based on the function of one of the basic elements of the human organism, i.e. of the proteins.

The final section featured several lectures associated with this subject, that surpassed however the experiences of nano technology. *Aural A. Lazar* (Columbia University) presented a novel encrypting principle permitting the encryption and management of the data by means of information of the least amplitude and time intervals not requiring any synchronization. An exciting lecture could also be heard from Tamás Roska on similarly novel computers using the nano technology tools and concepts modelling and detecting the cerebral functions.

Angela Hullmann has been attending the Conference as a special guest, as a representative of the EU Research Development Board. She instructed the attendees of the Conference on the diverse programs, including a detailed presentation about the fields concerned by nano technology and the amount of the programs that are working all around this subject. Numerous have been the programs the Hungarian experts have been participating in, in close cooperation with the most successful researchers of Europe. We could get acquainted with the crucial elements of the next program; this event can be joined by anyone, but individuals are advised to keep in step with the joint development project during the period before 2007, to be familiar with the outputs and working methods of their researching associates, thus having the chance to enter the joint project.

Norbert Kroó (HAS) has been closing the Conference, outlining every future outbreak points of nano technology. He linked the results achieved with the possible effects of the present researches. This rendering helped also to rank properly the scope of telecommunications, which has been hitherto a neglected area. In addition, he has been mentioning strategic tools and diverse materials that are commonly used in our everyday life. Accordingly, the apparition of clothes is imminent in the near future that will be much more resistant in strength, but more casual in wearing. This overview brought altogether the final teaching that nano technology will certainly have a dominant impact on the different scientific areas and services, but its proliferation will take place at different rates. The grounds of this do not lie with the research achievements; the substitution of a lot of areas, as yet, is not justified by either the appearance of novel features or by the commercial constraints.

The foils of the Conference are available on CD (Katalin Forrás, 481-7456), and can be obtained by everyone concerned. Thus we are striving to support the basic goal of the Conference, i.e. to get Hungarian researchers and developers to be familiar with nano technology, and to inspire them to have a conception about it as an alternative possibility.