CHIMIA **2002**, *56*, No. 10

EDITORIAL

Nanoscience and Nanotechnology

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'Nanoscale science' started in 1960 with Feynman's famous quote 'There is plenty of room at the bottom'. He pointed towards the world of atoms and molecules, and the potential to use them as devices and machines in the nanometer dimensions. This might finally lead to new technologies. However, as known from other recent examples such as microelectronics or biotechnology, tremendous scientific work has to be done before a new innovative technology emerges.

On the other hand, science and technology related to the nanometer range is a broad field, comparable to information science and technology, influencing nearly all our traditional industries and creating new branches.

There are several reasons why nanoscience and nanotechnology are presently hot topics, and ongoing activities are observed in every industrialized country.

Since 1981, we use new microscopes called scanning probe microscopes, in addition to optical and electron microscopes showing atomic resolution and working in air, liquids, etc. We can now deal with single atoms and molecules, even if they are not diluted, but arranged densely. We have the facilities to measure the chemical bonding force between two single Si atoms. These are the tools Feynman had in mind, but that did not exist in 1960.

Recently, new materials, in particular entirely new carbon-based materials such as C60 and carbon nanotubes have been discovered. These materials show superb physical and chemical properties which could lead to new applications.

We are fascinated by miniaturization, which means cheaper, less material and exact copies. The last decades were dominated by top–down approaches. Today, the more chemistry-related bottom-up approach is favored. Self assembly is a key issue.

Finally, nature seems to be the best system to function on nanometer dimensions. Nature is optimized regarding to materials, energy consumption, and data handling. Since on the nanometer scale already the traditional disciplines physics, chemistry, and biology merge, also medicine will fully profit from new discoveries on nanoscale dimensions.

In this volume we will focus on topics where Switzerland's research is strong and unique. We will start with chemistry-related contributions like the background of this journal implies. We will extend to biology and medicine. The key role of the future could be nanomechanics. Recently, the millipede, a terabit mechanical data storage device of IBM has found great attention. We then turn to more application-oriented topics, nanocontact printing and nanoreplication. Two contributions follow showing the potential of carbon nanotubes in the field of cold cathode luminescent tubes for lighting applications and field emission displays.

Finally, we present outlooks on other nano fields where the potential of future applications could evolve. Everybody can imagine what we will gain if in the future expensive chip fabrication in clean rooms can be replaced by new devices under the protection of cheap liquids only.

There are currently two initiatives in Switzerland to stimulate research in the field of nanoscale science and technology, the TOP NANO 21 (see: *www.ethrat.ch/nano*) and the NCCR Nanoscale Science (see: *www.nccr-nano.org*). We recommend these two web sites for more information.

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It is with great pleasure that the Editorial Board of CHIMIA expresses its warmest thanks to the coordinating guest editors Prof. Hans-Joachim Güntherodt and Prof. Wolfgang Meier acknowledging their broad and interesting selection of authors and topics as well as the efficient realization of the present issue on 'Nanoscience and Nanotechnology'.