New Avenues in Inorganic Chemistry

Among the chemical disciplines, inorganic chemistry has traditionally been open to new directions into materials. Visions of future technologies challenge the inorganic chemist to produce materials with new and, in particular, designer properties, sometimes with surprising results. For instance, the demand for miniaturization led to the discovery that a decrease in size does not give a continuous trend in properties.

Inorganic chemistry has a role in materials science

Nanoscience, and in consequence nanotechnology, both deal with the special properties and the pattern of behaviour of any kind of material on the nanometer scale. At these dimensions the classical differences between physics, chemistry, and biology become meaningless. This can be considered as a scientifically new, holistic concept. Nanoscience and -technology, therefore, are not to be considered as novel scientific disciplines in a classical sense. Rather they unify apparently different fields on the nanoscale. Classical physical laws can no longer be applied to describe the propeties of a particle of any chemical composition if its dimension falls below a critical dimension. The investigation of individual nanoparticles, especially with respect to their electronic, optical or magnetic properties, has therefore been in the focus of interest for many research groups around the world over the last few decades. Consequently, our knowledge on the properties of, for instance, semiconductor and metal nanoparticles, is quite advanced. We indeed now understand the dramatic change of properties on the way from the bulk state to the nano state: quantum size effects begin to dominate and corresponding theories replace those of classical physics.

Nanoscience blurs the borders between disciplines

There is, however, still a dramatic gap in our knowledge on the behaviour of three-, two- and one-dimensional arrangements of those nanoparticles. How do they communicate? What is the role of the matter in between? Which kind of forces hold organized particles together? How do nanoparticles interact with biomolecules? Numerous other questions can be formulated for these arrangements. Last but not least, it is important to think about applications of communicating nanoparticles in future electronic devices, sensors, storage systems etc.

In many countries, funding bodies have initiated projects with the goal of bringing together physicists and chemists in order to find answers to the numerous questions arising in connection with the organinization of nanoparticles. Some of the relevant results of a research program supported by the Deutsche Forschungsgemeinschaft (SPP 1072), entitled "Semiconductor and Metal Nanoparticles as Building Blocks for Organized Structures" are now published as peer reviewed papers in this issue of the *European Journal of Inorganic Chemistry*. Besides producing a series of important results, a second effect has been reached by the program: several groups started successful collaborations, especially fruitful between physical and chemical research partners, since, as mentioned before, these disciplines meet each other on the nanoscale. From the publishing point of view another consequence was evident: since the peer review was necessarily international, cross-border stimulation of ideas was a interesting side-effect, illuminating new aspects of the study. Some authors specifically mentioned that the comments were particularly valuable.

International and interdisciplinary contacts stimulate innovative research

As a large part of the acquired results has already been published elsewhere in the course of the last past years, this issue contains an unusual number of microreviews. We hope that this collection of results from cooperative research will stimulate still more groups to initiate interdisciplinary and international collaborations in the field of nanoscience and nanotechnology.

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