Editorial

Metal nanoclusters have been wittily called "strange morsels of matter" by R. Pool in an interesting note that appeared in *Science* in 1990. We agree with him in that metal nanoclusters are to be considered as links between bulky and molecular matter and insofar they represent a unique kind of species. Depending on the temperature and especially on the applied physical method we use to investigate them, they may still behave as a piece of metal or as a molecular-like system that has to be described by means of quantum mechanical rules rather than with those valid for classical physics. In the size regime below ~2 nm quantum properties dominate. Nanoclusters of that size indeed exhibit discrete electronic energy levels like atoms do. This is why they are also called artificial big atoms. It can be foreseen that nanoclusters of that size will play a decisive role in future nanoelectronic devices as single electron switches or transistors. Furthermore, metal nanoclusters begin to significantly influence developments in medicine. Due to their size, they can interact with cell components that are also located on the nanoscale. Novel discoveries in diagnosis as well as in therapy foreshadow chances that never existed before. So, metal nanoclusters are not only fascinating scientific objects, but also applicable in many important practical fields.

In fact, metal nanoclusters are no longer only "strange morsels of matter" but they are designable key components of most important research- and industry-relevant catalysts in chemical processing. In supported metal (0)-based metal catalysts, the metal nanoclusters size is obviously related to the catalyst activity in that this feature relates to specific active surface area. However, for structure-sensitive reactions, metal nanoclusters size (and even shape) relates also to catalytic chemoselectivity. In this specific connection, a paradigmatic example is the remarkable ability of nanostructured Au^0 to catalyse the oxidation of CO to CO_2 with dioxygen in the presence of large excess of dihydrogen only if metal nanoclusters size is close to 3 nm.

Most metal nanoclusters employed in catalytic applications are made up of one metal only. Indeed they may be bi- and polymetallic clusters. In the conventional metal catalysts, bi- and polymetallic nanoclusters or nanoparticles are supported on inorganic supports. The second and third metal can exert a strong effect on activity and selectivity of metal catalysts albeit this effect is not completely clarified. Therefore, the design of polymetallic catalysts is not yet well established, although engineers are eager for it. Now, scientists can control the size and, to some extent, the structure of bimetallic nanoclusters. For example, bimetallic nanoclusters with a core/shell structure are very popular now. If the total size of bimetallic clusters is less than 2 nm, the core could be surrounded by the only one-atom-layered shell. The catalytic property of active site in the shell element can be easily altered by core elements. This will provide a new concept for the catalyst design. Nanotechnology can also provide a tool to design supported catalysts by combination of metal nanoclusters with nanoparticles of inorganic metal oxide. Now, after a long history as metal colloids since Faraday's times, metal nanoclusters have gained a definite position in science and technology.

This book is aimed at being a reference book for all scientists who need to play with the physics, the structure and the chemistry of metal nanoclusters. Its content is organised in two parts in such a way that it may be considered as a textbook (*General Aspects*, Part I) and as a handbook (*Methodologies*, Part II). In the name of the numerous scientists who contributed chapters to the book, we do hope that its presence in the bookshelves of many scientists all over the world for a number of years ahead, will be reassuring for the design, synthesis and characterisation of many useful "strange morsels of matter".

Benedetto Corain Günter Schmid Naoki Toshima