Preface

Zhuangzi (Chaung Tzu), a philosopher of ancient China, wrote “looking at the sky through a tube” as a metaphor for shortsighted recognition (in *Autumn Floods*, an outer chapter of *Zhuangzi*). As seen in children’s games, however, “looking through a tube” often gives attractive and stimulating landscapes. The restricted and low-dimensional sight can clarify unusual aspects of the scenery hidden in an ordinary view. Does it hold for materials chemistry? The answer is yes.

From the last quarter of the twentieth century, chemical science has discovered structural design at nanometer scales, being larger than the size of single molecules but much smaller than that of practical materials, as an important key for developing novel advanced materials. Shape anisotropy has also been found as another key that facilitates gradient functions in a system by asymmetric location of functional moieties. Research interests have created various nano-objects and nanospaces in the materials world. Today, they are recognized as important building blocks or matrixes for constructing advanced materials with the integration of plural functional moieties.

Inorganic nanosheets are two-dimensional particles with nm-level thickness. In particular, they mean crystalline inorganic monolayers provided by exfoliation of inorganic layered crystals. The exfoliation has been developed as an extension of intercalation phenomena that are the events in the two-dimensional interlayer spaces of the layered crystals. In fact, the exfoliated inorganic nanosheets and the interlayer spaces, being two sides of the same coin, have contributed as anisotropic nano-objects or nanospaces to developing nanostructured materials. Various nanosheet-based architectures have been constructed often with immobilizing functional molecules in the nanospaces or on the nanosheets themselves. Recently, the research field has been progressing and expanding more and more as stimulated by the Nobel Prize for graphene in 2010. Publications including the word “nanosheet” exceeded 2,800 in 2015, although they were fewer than 10 in 2000 (by SciFinder).

Based on such research development, we decided to summarize current materials chemistry of the inorganic nanosheets in this book. We aimed at bundling diverse aspects of inorganic nanosheets, e.g., nanosheet preparation, hybridization with other materials, and various applications, to give a concise summary of the inorganic nanosheets and nanosheet-based materials. Fortunately, we succeeded in collecting contributions from many leading researchers involved in this area.

This book is composed of two parts. Part I provides fundamental aspects. The research area is overviewed, and preparation, properties, and fabrications of representative inorganic nanosheets, i.e., clay minerals, oxometallates, graphene, metal dichalcogenides, are summarized. Interactions of the nanosheets and their 2D interlayer spaces with organic and polymer species, which are the critical basis of fabricating nanosheet-based assemblies, are described. Moreover, colloidal properties of the nanosheets are also depicted, exploring their utilization in the field of soft matter.

Part II collects applications of the nanosheet-based materials. They are extended to various fields: adsorption, sensing, electric, optic, energy conversion, and biological functions, covering broad state-of-the-art research topics. Among them, photochemical and electrochemical functions related to energy conversion and storage are described in detail because these functions are highly sensitive to microenvironments and hierarchical arrangements of the reaction molecules as seen in natural photosynthetic systems.

Finally, we express our sincere thanks to all the authors who contributed to this book with their deep insights into this field.

Kitakyushu, Japan Teruyuki Nakato
Yamaguchi, Japan Jun Kawamata
Hachioji, Japan Shinsuke Takagi

http://www.springer.com/978-4-431-56494-2

Inorganic Nanosheets and Nanosheet-Based Materials
Fundamentals and Applications of Two-Dimensional Systems
Nakato, T.; Kawamata, J.; Takagi, S. (Eds.)
2017, VIII, 542 p. 291 illus., 168 illus. in color., Hardcover
ISBN: 978-4-431-56494-2