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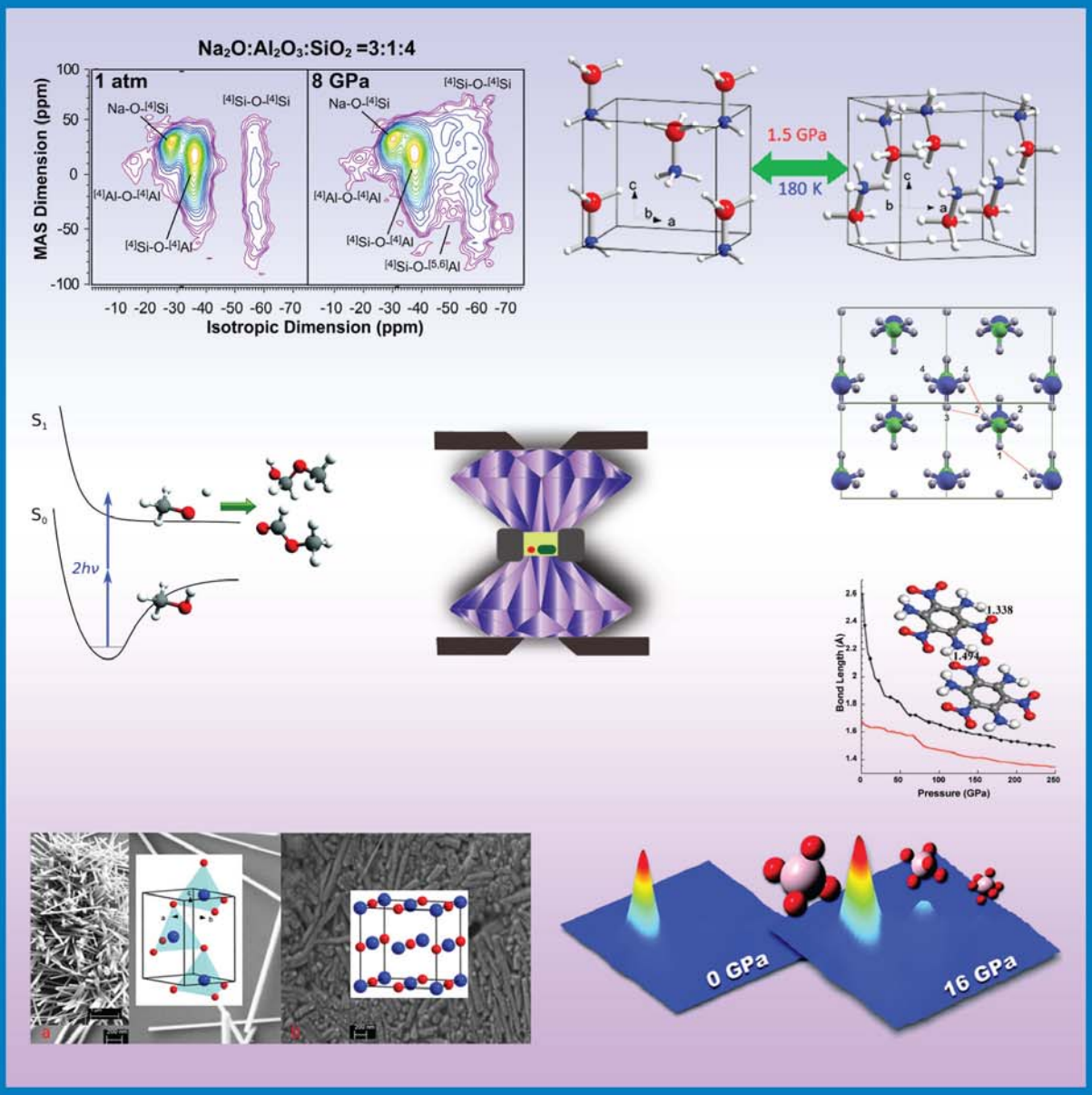

Diamond Anvil Cell-Enabled High-Pressure Phenomena in Chemistry and Materials Science (see page 5A)

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SPECIAL ISSUE PREFACE

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New Trends in Chemistry and Materials Science in Extremely Tight Space

Pressure plays a critical role in regulating the structures and properties of materials. Since Percy Bridgeman was recognized by the 1946 Nobel Prize in Physics for his contribution to high-pressure physics, high-pressure research has remained an interdisciplinary scientific frontier with many extraordinary breakthroughs. Over the past decade or so, in particular, high-pressure chemistry and materials research has undergone major advances with the discovery of numerous exotic structures and properties. Brand new classes of inorganic materials of unusual stoichiometries and crystal structures, which have a wide range of optical, mechanical, electronic, and magnetic properties, have been produced at high pressures. Pressure-induced phase transitions between crystalline and amorphous materials, as well as among insulators, conductors, and even superconductors, have been extensively documented. Most significantly, the high-pressure development of functional materials with potential industrial applications, such as high-energy density materials, superhard materials, and hydrogen storage materials, has become a vibrant area of high-pressure research. Overall, high pressure has become a unique and powerful tool for the discovery of new materials and the understanding of new phenomena with important implications in chemistry, physics, biology, materials, and earth sciences. The rapid developments in high-pressure techniques (e.g., diamond anvil cells, multianvil press, and dynamic shock) have allowed the generation of extreme conditions in a broad pressure—temperature range with great controllability and accuracy. New emerging analytical probes including optical spectroscopy, synchrotron, and neutron sources have enabled detailed insight into the material structures with unprecedented spatial, temporal, and spectral resolutions. In parallel, theoretical computations under extreme pressures have successfully reproduced experimental observations, proposed new high-pressure perspectives, and yet posed new challenges. The recent advances in high-pressure science, especially in chemistry and materials, have been documented in several review articles and books.[1−6]

Under this context, the papers in this special issue are based on a symposium entitled "*Chemistry and Materials Science at High Pressures*" held at Pacifichem 2010, in Honolulu, Hawaii, on December 18−19, 2010. Founded in 1984, Pacifichem congresses have been held in Hawaii around every five years. Organized by six chemical societies with the Canada Society for Chemistry being the congress host, the theme of Pacifichem 2010 was chemistry, technology, and our global environment. The objective of the conference was to promote collaborations among Pacific Basin scientists to improve the quality of life throughout the world. This symposium, in particular, addressed a unique theme of high-pressure phenomena in chemistry and materials. We expected the symposium to provide a platform to exchange new ideas, to explore new trends, and thus to foster new international collaborations by bringing together the expertise and by highlighting recent contributions in this focused area. To our understanding, it was the first time that Pacifichem featured the theme of chemistry and materials under extreme conditions, especially at high pressures. The symposium covered the following prevailing directions in high-pressure chemistry and materials research: (1) Reactions, synthesis, and kinetics; (2) Structures, properties, and transitions; (3) Functional materials and applications; (4) Earth materials and geochemistry; (5) Advances in high-pressure techniques; and (6) Theoretical and computational modeling. In addition, one of the symposium sessions was dedicated as a memorial session to Prof. Malcolm Nicol (1938−2009), a well-recognized high-pressure chemist and materials scientist who served as a senior editor for this Journal for many years throughout the 1980s.

The two-day symposium was co-organized by the guest editors of this special issue and Prof. Ian Butler (McGill University, Canada) and Prof. Yongjae Lee (Yonsei University, South Korea) and was well attended by over 50 delegates from 6 countries. The details of the symposium can be found online: http://minime.chem.uwo.ca/~pacifichem/.

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