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Preface

Today mankind is confronted with energy and environmental problems. The ultimate solution to the energy problem is the effective use of solar energy. With respect to the environmental problem, one solution is the development of reaction processes that are free from unwanted by-products. Photoreaction control is expected to be a key technology in solving both of these problems. Photoreaction control is, in our definition, a technology to control reactions at the atomic and molecular levels by using photons. We expect that it will enable us to develop efficient artificial photosynthesis, highly selective synthesis of materials, and material processing on the nanoscale.

It should also be recognized that in this new information age, the needs for high-speed and high capacity information processing and transmission are intensified. Optical information processing is expected to be a means to solve this problem, and the development of photofunctional materials is vital for the realization of optical information processing.

The National Institute of Advanced Industrial Science and Technology (AIST) has been continuing the "photoreaction control and photofunctional materials" project since 1997 with the aim described above. The seventh AIST international symposium on photoreaction control and photofunctional materials (7th AIST PCPM) was held on 17–19 January 2006 in Tsukuba, Japan as one of the activities associated with this project.

The topics covered in the symposium include photoreaction mechanism, light energy conversion, laser-induced reaction and photofunctional materials. Twenty-four lectures were delivered. The poster sessions were held separately and 100 posters were presented. A total of 235 people attended this symposium. This special issue collects most of the papers delivered as lectures.

The first five papers are concerned with photoreaction mechanism. Dr. Nagai (AIST) reports observation of the phase lags among the molecules in the coherent phase control of multiphoton ionization. Prof. Lin (Kansas State Univ.) illustrates how short intense laser pulses are used to probe the structure of molecules through tunneling ionization and harmonic generation. Dr. Kakehata (AIST) reports generation of optical field-controlled high-intensity laser pulses. Prof. Durrant (Imperial College) discusses monomolecular triplet decay dynamics in fluorene-based polymer films studied by transient absorption spectroscopy. Dr. Barzykin (AIST) discusses stochasticity of photophysical processes in nanosystems such as nanotubes and conjugated polymers.

The next four papers deal with photofunctional materials. Dr. Ouchi (AIST) reports control of electronic states and photochemical reactivities of C_{60} by chemical functionalization. Prof. Barrett (McGill Univ.) reports novel photoswitching using azobenzene functional materials. Dr. Azumi (AIST) discusses correlation of molecular structure, packing motif and thin-film transistor characteristics of solution-processed n-type organic semiconductors based on dodecyl-substituted C_{60} derivatives. Dr. Fukuda (AIST) reports molecular design and synthesis of copolymers with large photoinduced birefringence.

The following six papers are concerned with light energy conversion. Dr. Saito (AIST) reports investigation of optimum conditions for high-energy organic thin-film solar cells based on polymer blends. Dr. Furube (AIST) reports near-IR transient absorption study on ultrafast electron injection dynamics from a Ru-complex dye into nanocrystalline In_2O_3 thin films. Prof. Bisquert (Univ. Jaume I) reports continuous time random walk simulation of short-range electron transport in TiO_2 layers compared with transient surface photovoltage measurements. Dr. Yanagida (AIST) discusses reverse electron transfer at the interface of semiconductor film in dye-sensitized solar cells. Dr. Isram (Sharp Corp.) reports improvement of efficiency of dye-sensitized solar cells based on analysis of equivalent circuit. Dr. Himeda (AIST) reports highly efficient conversion of carbon dioxide catalyzed by half-sandwich complexes with pyridinol ligand.

The final six papers treat laser-induced reaction. Dr. Helvajian (Aerospace Corp.) reports selective activation of material property changes in photostructurable glass ceramic materials by laser photophysical excitation. Dr. Kawaguchi (AIST) reports rapid prototyping of silica glass microstructures by the LIBWE method. Dr. Nishii (AIST) reports self-alignment of Ge nanoparticles in laser-induced Bragg grating in Ge-B-SiO_2 film. Prof. Meunier (Ecole Polytech., Montreal) reports laser ablation-based synthesis of functionalized colloidal nanomaterials in biocompatible solutions. Dr. Sasaki (AIST) reports preparation of metal oxide-based nanomaterials using nanosec-

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ond pulse laser ablation in liquids. Dr. Seto (AIST) reports synthesis of magnetic CoPt/SiO_2 nanocomposite by pulsed laser ablation.

As the organizer of 7th AIST PCPM and the guest editor of this special issue I hope that this special issue stimulates further studies in the field of photoreaction control and photofunctional materials.

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