Journal of Photochemistry and Photobiology A: Chemistry 221 (2011) 129

Contents lists available at ScienceDirect

Journal of Photochemistry and Photobiology A: Chemistry

journal homepage: www.elsevier.com/locate/jphotochem

Preface

This special issue of *Plasmonic Photochemistry* focuses on the chemical and physical consequences of light-field enhancement from nanostructures prepared by top-down and/or bottom-up methods using plasmonic nanoparticles of Au or Ag. Photochemical research, including research on photocatalysts, solar cells, optical memories, and photoresists, focuses on the use of light as an energy source for the development of technology that contributes to the prosperity of society in many ways. However, the ability to increase photon–molecule interactions through conventional photochemical molecular science and technology or engineering is limited. It is difficult to find a way to excite molecules in a highly efficient manner using very small number of photons/light. To overcome this limit and to create a highly efficient excitation process, we need to invent a "strong photon–molecule coupling field" that allows strong photon–molecule interactions.

The studies presented in this special issue describe how to create a "strong photon–molecule coupling field" by designing and building a nano/micro structure that will confine photons and promote light–matter interaction. Achievements shown in this issue prove that tailored systems to control various light enhancement effects of light dispersion and propagation, nano-antennas, lightning rods, shape–polarisation coupling, nonlinear frequency up-conversion and harmonics generation, and enhanced scattering and emission could lead to a paradigm shift of conventional photochemistry. Nonlinear photochemical reaction initiated by an incoherent light source, plasmon-assisted photocurrent generation via water oxidation, and acceleration of photochromic reaction induced by localized surface plasmon are novel attempts towards completely distinct photochemical reactions which cannot be induced by without using a "strong photon–molecule coupling field". Enormous repercussions in the fields of photo-physics, material science, and biological application were also shown both in theoretical and experimental demonstrations. The innovative designs of a "strong photon–molecule coupling field" show tremendous promise for useful photoenergy-converting applications to solve the global energy problem.

We are very happy to summarize our achievements in this special issue. The contents are based on the discussion in a symposium, "Nanostructure-Enhanced Photochemical Reactions", which was organised as part of the 2010 International Chemical Congress of Pacific Basin Societies (Pacifichem 2010) held December 15th–20th, 2010, in Honolulu, Hawaii, USA. The symposium was organised by Professors Mostafa A. El-Sayed, Ken Ghiggino, and Prashant Kamat along with the corresponding organiser, Hiroaki Misawa. We thank all the speakers there and the authors who contributed to this special issue.

Thanks are also due to the KAKENHI (Grant-in-Aid for Scientific Research) project on Priority Area "Strong Photon–Molecule Coupling Fields for Chemical Reactions" (no. 470, head investigator, Hiroaki Misawa) from the Ministry of Education, Culture, Sports, Science and Technology of Japan for supporting the symposium. The members of the international advisory board—Professors Hiroshi Masuhara, Katsumi Tokumaru, Toyoki Kunitake, Haruo Inoue, Thomas W. Ebbesen, Johan Hofkens, and Sajeev John—provided insightful comments and suggestions for the project.

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Available online 12 June 2011

1010-6030/$ – see front matter
doi:10.1016/j.jphotochem.2011.06.004