Center for Molecular Spectroscopy and Dynamics, IBS-Korea University

IBS Center for Molecular Spectroscopy and Dynamics

COLLOQUIUM

- **SPEAKER**
  Prof. Wooyul Kim (Department of Chemical and Biological Engineering, Sookmyung Women's University)

- **TITLE**
  Photocatalysis for Environment and Energy Application

- **ABSTRACT**

The subject of photocatalysis is highly interdisciplinary and being investigated by chemists, physicists, materials scientists, chemical and environmental engineers, microbiologists, etc. across the areas for both environmental and energy application. Despite intensive research efforts devoted to photocatalysis for last 3 decades, the complete understanding of photocatalysis phenomenon and the mechanisms is still far away. Firstly, we addressed an important and popular question of why anatase and rutile forms of titania exhibit different photocatalytic activities. Although this question has been frequently dealt with, here a new view based on the molecular behavior of photogenerated OH radicals was proposed. Briefly, the photogeneration and the subsequent diffusion of •OH from the illuminated TiO2 surface to the aqueous solution bulk were successfully observed using a single molecule detection method, which is the first report of this phenomenon. The mobile •OH is generated on anatase but not on rutile. The molecular-level events occurring on irradiated anatase (not rutile) and the macroscopic photocatalytic behavior in bulk slurry systems can be successfully correlated. As a second part for energy application, binuclear photocatalysts was developed for accomplishing the complete photosynthetic cycle on the nanoscale. These robust all-inorganic assemblies feature donor and acceptor metals bridged by an oxo-atom and are covalently grafted onto the silica surface through formation of metal-silanol bonds. Efficient coupling of light absorber and multi-electron catalysts for carbon dioxide reduction or water oxidation is one of the most challenging tasks for artificial photosynthesis. In order to accomplish directional electron transport from the water oxidation sites to CO2 reduction sites via ZrOCo binuclear chromophores with minimum loss of energy, a photodeposition method was developed that affords coupling of the water oxidation catalyst (IrOx) with the Co donor metal and CO2 reduction catalyst (CuxOy) with Zr acceptor metal, respectively. In ZrOCo-IrOx SBA-15 assembly, we achieved robust, polynuclear assemblies for closing the photosynthetic cycle of carbon dioxide by water. In reduced CuxOy-ZrOCo SBA-15 assembly, we precisely manipulated the oxidation state of surface Cu centers via second photoreduction process and revealed their role for CO2 reduction

- **DATE AND VENUE**
  April 25, 2018 (Wednesday, 5:00 - 6:00 pm)

Seminar Room 116, KU R&D Center

- **LANGUAGE**
  Korean

- **INVITED BY**
  Prof. Kyungwon Kwak

*If you want to have dinner with Prof. Wooyul Kim or discuss with him, please contact Prof. Kyungwon Kwak (kkwak@korea.ac.kr).