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Title: Photochemistry of Solid Materials from Fundamentals to Applications

Abstract: Photocatalysis for energy conversion and environmental decontamination and dye-sensitized solar cells are examples of practical application of photochemistry of solid materials. Although such photochemistry of solid materials have been extensively studied and reported, its fundamentals, thermodynamics and kinetics, have been still under discussion and therefore characterization of those functional solid materials are still performed empirically not based on the thermodynamics and kinetics. In this course, the thermodynamics and kinetics are reexamined and discussed for characterization, material design and fabrication.

Topics in the course are as follows:

- (1) What is science: Its logic and philosophy
- (2) Practical application of photocatalysis
- (3) Mechanism of photocatalysis
- (4) Band position of semiconductor photocatalysts
- (5) Thermodynamics
- (6) Photocatalytic water splitting
- (7) Visible-light responsive photocatalysis
- (8) Kinetics and photocatalytic activity
- (9) Quantum efficiency and action spectrum analysis
- (10) Light-intensity dependence
- (11) Structure-activity correlation: statistical analysis
- (12) Anatase-rutile mixed particulate photocatalysts
- (13) Polyhedral faceted titania particulate photocatalysts
- (14) Electron traps in photocatalysts
- (15) Identification of compound: organic molecules and metal-oxide particles