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Development of advanced functionalities on metal oxide nanoparticles

Development of functional materials has been extensively studied in the field of materials chemistry. We have reported various unique magnetic functional materials using cyano-bridged bimetallic assemblies, e.g., the photomagnetic functionalities on iron-octacyanoniobate systems, light-induced spin-crossover magnetic phenomenon, and photo reversible light induced spin-crossover phenomenon, spin-crossover-induced second harmonic generation, and photo switching of magnetization-induced second harmonic generation. Based on these knowledge, we developed novel metal oxide nanoparticles with advanced functionalities such as epsilon-iron oxide (ε-Fe_2O_3) and lambda-trititanium pentaoxide (λ-Ti_3O_5). This presentation focuses on λ-Ti_3O_5. A unique phase of Ti_3O_5, λ-Ti_3O_5, was prepared as nanoparticles. By alternatively irradiating with 532 nm and 410 nm lights, phase transition between λ-Ti_3O_5 (black, metallic conductor) and beta(β)-Ti_3O_5 (brown, semiconductor) was repeatedly observed at room temperature. Thermodynamical analysis suggests that λ-Ti_3O_5 is a trapped phase at a local energy minimum. Light irradiation causes the reversible switching between this trapped state (λ-Ti_3O_5) and the other energy minimum state (β-Ti_3O_5). Furthermore, we have recently reported that the reversible switching is also induced by other external stimulation such as pressure, and have found that this material exhibits high performance heat storage properties, which are understood from thermodynamic studies.

Speaker Biography

Shin Ichi Ohkoshi is currently working as a Vice Dean at School of Science, The University of Tokyo, Japan. He Published 423 papers, having 174 applications for Patent and 173 Invited presentations. His Current research interests are in the areas of inorganic chemistry and physical chemistry, i.e., magnetic materials, phase transition materials, nanomagnetic materials, light-induced phase transition, etc.

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