Synthesis of oxynitride nanosheets and graphene oxide and their functions (photocatalysis and fuel cells)

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Research on two-dimensional materials, such as graphene, oxide nanosheet and transition metal dichalcogenides, has also made significant progress. Various new devices, including field-effect transistors (FETs), pn/heterojunction devices, flexible devices, artificial muscles, and sensors, have been proposed. While applied research on nanosheets is advancing, there is a trend of fewer studies on the synthesis of novel nanosheets than before. Additionally, as applied research on nanosheets progresses toward practical applications, there is a growing need for research from the perspective of shaping and processing nanosheets into forms and sizes that can be handled as nano-materials. This talk addresses new types of metal oxynitride nanosheets, metal nitride nanosheets, and oxide graphene and their self-assembled membranes, and their electrochemical functionalities, including their application in fuel cells.

Oxynitride Nanosheets: oxynitrides often exhibit superior functionality in the fields of photocatalysis, catalysis, ferroelectric devices, and luminescent devices compared to oxides. In this talk, we discuss oxynitride semiconductor nanosheets with controllable bandgap and their photocatalytic activity.

Nanosheet Self-Assembled Membranes: single-layer nanosheets can easily form laminated structures by bonding face-to-face, differing significantly from lower-dimensional nano-materials (nanoparticles) composed of point-to-point junctions. In this presentation, we report on the fabrication of titanium oxide nanosheet self-assembled membranes using the spin-coating method. Various nanosheet self-assembled membranes can also be produced using suction filtration, and depending on the type of nanosheet, they can function adequately as electrolyte membranes for hydrogen fuel cells.