Black Phosphorous Composite Nanomaterials: Photocatalytic Degradation of Organic Pollutants in Water

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Two dimensional materials have showed a great potential as visible light responsive photocatalysts. These materials boast remarkable electronic, optical and catalytic properties which has led to their applications in various fields including photocatalytic processes. Black phosphorus (BP), an emerging direct band gap 2D material has come to the fore front in recent years as it bridges the gap between band gapless graphene and wide band gap transition metal dichalcogenides (TMDs). Black phosphorus is an allotrope of phosphorus alongside white and red phosphorus, however it is more thermodynamically stable than its two counterparts.

The fabrication of a metal-organic framework with two-dimensional materials as nanocomposites for photocatalytic water splitting and environmental remediation has been of focus lately. The work to be presented in this conference, focuses on the composites between MIL-125 (Ti), Nb_2O_5 and few-layer black phosphorus (FLBP). The as-synthesized composites materials were characterized using Transmission electron microscopy (TEM), scanning electron microscopy (SEM), X-Ray diffraction (XRD), ultraviolet-visible diffuse reflectance spectra (UV-Vis DRS) and photoluminescence (PL) spectra. The techniques revealed that the nanocomposites exhibited different morphologies, with improved optical properties and thus could be applied in visible-light-driven photocatalytic water treatment or water splitting. Electrochemical impedance spectroscopy (EIS) and PL measurements further showed that the composites displayed the lowest charge recombination relative to the pristine materials, in-turn their improved photocatalytic activity on organic pollutants in water.

Keywords: metal organic framework, black phosphorous, heterojunction, electron transfer