National Institute of Technology Rourkela

Defence Seminar

Seminar Title : Development of Visible Light Promoted Carbon-Carbon and Carbon-Heteroatom Bonds Employing Heterogeneous Photocatalysts
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Venue : Seminar Hall, Chemistry Department
Date and Time : 13 Aug 2025 (11:15 AM)
Abstract :

Photochemical techniques have grown to be effective approaches in contemporary synthetic organic chemistry that has an impact on the life science sector, mostly due to the ease of access to laboratory equipment. The outstanding electronic characterized heterogeneous metal-free 2D semiconductor g-C_3N_4 and the metal doped g-C_3N_4 are an emerging alternative redox catalyst to conventional thermochemical catalyst, where it functions as a high-performance photocatalyst towards a sustainable synthesis of high-value organic molecules. Graphitic carbon nitride (g-CINI) has demonstrated remarkable potential as a sustainable, metal-free photocatalyst in various oxidative transformations under mild conditions. Its photocatalytic activity enables efficient oxidation of alkenes, alkanes, and readily available carboxylic acids, as well as the selective oxidation of (hetero)aryl methyl halides to the corresponding (hetero)aryl carboxylic acids using sunlight and atmospheric oxygen as the sole oxidant. Notably, the in situ generated by-product, HBr, can be recycled for the synthesis of &*alpha*-bromo ketones, thereby offering a highly atom-economical and environmentally benign protocol with zero effluent discharge. Furthermore, g-CINI facilitates the decarboxylative benzylation of phthalimide derivatives using accessible arylacetic acids. The process involves visible-light-driven generation of benzyl radicals via decarboxylative photooxidation, which subsequently add to the carbonyl group of phthalimides to afford the desired products in excellent yields with broad functional group tolerance. Additionally, g-CINI promotes the radical-mediated oxidative difunctionalization of vinyl arenes with trimethylsilyl azide and molecular oxygen, producing &*alpha*-keto azides under visible light irradiation. These reactions underscore the versatility of g-CINI in driving complex photooxidative transformations, affirming its utility as a robust and sustainable photocatalyst in modern synthetic organic chemistry. A visible-light-induced photoredox catalytic system utilizing Cu@g-CINI as a heterogeneous catalyst has also been developed, demonstrating broad applicability in C&ndashN cross-coupling reactions between structurally diverse amines and aryl boronic acids, as well as in the efficient homo- and hetero-coupling of terminal alkynes. The protocol proceeds under base-free conditions with significantly reduced reaction times, highlighting its potential as a sustainable and versatile synthetic approach.