INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Fabrication and Characterization of CVD Graphene Based Hybrid Nanostructures for Photoconductive and Photocatalytic Applications

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SHORT ABSTRACT

Achieving large area wafer scale single layer graphene onto dielectric substrates without having any structural defects and layer non uniformity is still challenging. There is a lack of in-depth understanding on the role of defects in the interactions between graphene and foreign atoms and molecules. Investigating the various in-plane and edge defects including functional groups on the graphene using resonance Raman spectroscopy and HRTEM will provide the rich physics behind its electronic and optoelectronic applications. Physical and chemical functionalization of graphene preserving its sp^2 crystallinity can reveal the change in the electronic structure due to covalent and noncovalent foreign material interaction with graphene. It is anticipated that a proper understanding on the interaction of noble metal with defective graphene would pave the way for controlled functionalization of graphene for cutting edge applications. Functionalized graphene and its exploitation in integrated optoelectronics is least explored in the literature. Further, origin of solid state PL from CDG is not understood well with the help of controlled environments. Fabrication and characterization of graphene based semiconducting hybrid NSs for enhanced photodetection applications is imperative to develop various optoelectronic devices. Visible light photocatalysis of graphene and functionalized graphene incorporating TM plasmonic hybrids are little explored. Graphene based TM plasmonic hybrid NSs for SERS and mechanism of SERS are still challenging. Unlimited possibility of exploiting graphene based hybrid NSs for photoconductive, photocatalytic and SERS applications still remains.

This thesis focuses on the controlled growth of large area defect free graphene using CVD technique and synthesis of CDG functional materials. Extensive investigations on number of graphene layers, uniformity, functionalization and defects were probed using micro–Raman spectroscopy and HRTEM. Next, the fabrication of graphene–plasmonic hybrids with TM NPs such as Au, Ag, Cu and organic molecules as well as the graphene– ZnO hybrid NSs and their SERS, photocatalytic and photoconductive applications were investigated.