PREFACE

The ever increasing demand for efficient syntheses of novel organic compounds remains the major driving force for the development of new and efficient solid-supported technologies. Solid-phase organic synthesis has emerged as a powerful tool for the generation of compound library. Polymer-supported reagents/substrates and polymer-supported catalysts have been widely employed in various fields of chemistry such as drug discovery, material sciences and asymmetric catalyses. Such process offers several advantages, which include possibility to use excess reagents to drive the reactions to completion, simplification of product work-up, separation and isolation as well as reuse of the catalysts, thereby providing an environmentally benign technique for green and cleaner reactions. The current emphasis for organic transformations requires high selectivity, easy separation and production of minimum waste. Immobilized reagents/substrates and immobilized catalysts can afford to greener organic transformations for laboratory to large-scale operations. As pointed out by Steven V. Ley, "the face of organic synthesis is changing rapidly as it should if it is to stay a healthy, vibrant subject. I feel, therefore, I should end with a vision of where we see the potential use of these immobilised systems in the future."

The development of new approaches for conducting organic reactions under greener reaction conditions constitutes an attractive area of synthetic organic chemistry. Solid-phase organic reactions and solid-phase immobilized catalysts have played a significant role in combinatorial synthesis small molecules of pharmaceutical interest. Over the last two decades, there has been insurgency in developing green chemistry and catalysis for sustainable organic synthesis.

In the recent years, graphene and graphene-based materials; such as graphene oxide (GO) and reduced graphene oxide (rGO) have been found to be extremely useful as alternative metal-free heterogeneous reusable catalysts for diverse organic transformations.

The present research work represents the development of some new approaches towards selective organic reactions promoted by inexpensive solid-surface like silica gel as well as catalyzed by GO and rGO. The present dissertation also includes the development of new polymer-immobilized metal catalysts for their applications in C–C bond-forming reactions.

The present works begin with **CHAPTER I** describing a brief introduction on solid-phase organic reactions mediated by heterogeneous solid supports such as silica, graphene-based materials and poly-ionic resins. **CHAPTER II** demonstrated about the silica gel promoted one-pot regioselective synthesis of dithioethers. **CHAPTER III** divided into two sections; **Section A and Section B**. **Section A** deals with "carbocatalysis" where graphene oxide (GO) has been exploited as a solid "carbocatalyst" for the chemoselective dithioacetalization of aldehydes. **Section B** demonstrates further utilization of GO or reduced graphene oxide (rGO) as efficient catalysts for one-pot metal-free synthesis of quinoxalines directly from 2-nitroaniline. In **CHAPTER IV** a comparative evaluation of diverse properties of chemically and biologically reduced graphene oxide along with their catalytic activity towards reduction of nitrobenzene has been described. Finally, **CHAPTER V** focused on the application of poly-ionic resins embedded with Pd/Cu bimetallic nanoparticles in Suzuki–Miyaura and Mizoroki–Heck reactions.