IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Coinage metal based catalysts containing dicationicphosphenium-based ligands**	
Project Number	**IMURA0936**	
MonashMainSupervisor (Name, Email, Phone)	Dr DraskoVidovic	*Full name,Email*
Monash Co-supervisor(s) (Name, Email, Phone)		
Monash Head of Dept/Centre(Name,Email)	Prof Philip Andrews	*Full name, email*
Monash Department:	School of Chemistry	
Monash ADGR (Name,Email)	Prof Peter Betts	*Full name, email*
IITB Main Supervisor (Name, Email, Phone)	Prof Maravanji S Balakrishna,	*Full name,Email*
IITB Co-supervisor(s) (Name, Email, Phone)		*Full name,Email*
IITB Head of Dept (Name, Email, Phone)	Prof Anindya Datta	*Full name, email*
IITB Department:		

Research Clusters:

Highlight which of the Academy's CLUSTERS this project will address? *(Please nominate JUST **one**. For more information, see www.iitbmonash.org)*	
1	*Material Science/Engineering (including Nano, Metallurgy)*
2	*Energy, Green Chem, Chemistry, Catalysis, Reaction Eng*
3	*Math, CFD, Modelling, Manufacturing*
4	*CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control*
5	*Earth Sciences and Civil Engineering (Geo, Water, Climate)*
6	*Bio, Stem Cells, Bio Chem, Pharma, Food*
7	*Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng*
8	*HSS, Design, Management*

Research Themes:

Highlight which of the Academy's Theme(s) this project will address? *(Feel free to nominate more than one. For more information, see www.iitbmonash.org)*	
1	*Advanced computational engineering, simulation and manufacture*
2	*Infrastructure Engineering*
3	***Clean Energy***
4	*Water*
5	*Nanotechnology*
6	*Biotechnology and Stem Cell Research*
7	*Humanities and social sciences*
8	Design

The research problem

Catalysis has always played an important role in fundamental research and the chemical industry. The very first industrial process (Lead chamber process) that was performed under catalytic reaction conditions was reported in the XVIII century. Ever since then and especially very recently with the evolution of green chemistry and sustainable development concepts, catalysis has played an integral part in fundamental research and, subsequently, the chemical industry. Catalysed reactions, in general, reduce energy requirements, reaction times and waste formation in comparison to non-catalysed procedures.

The chemical industry is always interested in the design of novel transition-metal based catalytic systems not only to improve the existing chemical transformations but also to enable those transformations that are currently extremely difficult to execute. Thus, we propose to prepare a series of coinage-metal based complexes that contain phospheniumdications as ligands. These complexes will thenbe investigated in hydrogenation, hydroxylation, hydroamination, hydroborylation and other similar transformations.

Project aims

1. *Preparation of a series of phospheniumdications stabilized by various carbodicarbenes or carbodiphosphoranes*
2. *Synthesis of coinage metal-containing complexes using phospheniumdications as stabilizing ligands*
3. *Catalytic exploration of coinage metal-containing complexes*

Expected outcomes

We expect to prepare a series of phospheniumdications which will then be used as supporting ligands for the synthesis of unique coinage metal based complexes.

We also expect that these complexes will have unique structural and electronic properties giving rise to exceptional and unprecedented catalytic activities.

Since the coordination and organometallic chemistry of this class of ligands is scant, the successful completion of this project leads to a significant and unique contribution in the area of coordination and organometallic chemistry.

How will the project address the Goals of the above Themes?

The initial efforts focus on understanding the reactivity and redox properties of phospheniumdications preferably with group 11 metals ions such as copper(I), silver(I) and gold(I) as they are known to form linear, trigonal planar or tetrahedral complexes. Further, coordinatively unsaturated complexes can coordinate one or two donor solvents such as acetonitrile or THF and such complexes are ideal for exploring catalytic applications in cyclization, three- or four-component reactions and other cross coupling reactions.

It is anticipated that some of these complexes can promote the catalytic reactions in an environmentally benign way involving solvent free conditions, sonication or mechano-chemical techniques.

Capabilities and Degrees Required

MSc or equivalent in chemistry. Knowledge in air- and moisture-sensitive chemistry is desirable.