

**Department of Chemistry**  
**Indian Institute of Technology Madras, Chennai-36**

Research Proposal Seminar

**Approaches for the synthesis of single-frame NHC ligand based heterobimetallic complexes: synthesis and catalytic applications**

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Date: 11-11-2019

Venue: CB-310

Time: 3.00 PM


Abstract:

N-heterocyclic carbenes (NHCs) are acknowledged as better  $\sigma$ -electron donors than classical ligands like phosphines, carbonyls, cyclopentadienyl, etc. Ease of alteration of their electronic as well as steric properties coupled with strong ligation ability made them an obvious choice for various metal-based chemistry especially catalysis.<sup>1</sup> Most of the organometallic catalysts are traditionally designed to mediate a specific type of functionalization in any catalytic reaction.<sup>2a</sup> The increasing demand for environmentally benign and economical synthetic processes necessitate the development of one-pot multiple catalytic transformations to provide desired products in most efficient ways.<sup>2b</sup> One of the ways to achieve this is to use single ligand based heterobimetallic complexes featuring two different metal centers capable of catalyzing two or more distinctly separate reactions simultaneously. But the design of efficient heterometallic complexes for one-pot catalysis suffers some complications such as: (i) the need for the two catalytically active sites to be compatible with the reaction conditions needed for each individual catalytic cycle, (ii) the possibility that single-frame ligand does not provide the stability needed to maintain the heterometallic nature of the catalyst during the whole catalytic process.<sup>3</sup> To overcome these problems ditopic ligand systems are required which can provide two distinct binding sites featuring strong donors (to prevent decomposition during catalytic cycle) for the coordination to metal atoms. Recent studies suggest that benzimidazolium as well as imidazolium based ditopic ligands serves as an excellent carbene precursors for the synthesis of heterobimetallic catalysts because their stereoelectronic properties can be tuned easily and they are capable of providing a rigid platform which may help to fix two metals effectively.<sup>4</sup> Therefore, with the objective of devising NHC based new ligand systems for the synthesis of effective heterobimetallic catalysts, the presentation will be focused on various approaches for the synthesis of diverse heterobimetallic catalysts and their applications in organic transformations. Research proposal and some preliminary results will also be discussed along with the future plans.

References:

1. Hahn, F. E. *Angew. Chem. Int. Ed.* **2006**, *45*, 1348.
2. a) Lee, J. M.; Han, H.; Chang S. *Chem. Soc. Rev.*, **2004**, *33*, 302.  
b) Buchwalter, P.; Rose, J.; Braunstein, P. *Chem. Rev.* **2015**, *115*, 28.
3. Mata, A. J; Hahn F. E.; Peris, E. *Chem. Sci.*, 2014, *5*, 1723.
4. Gonell, S.; Poyatos, M.; Mata, A. J.; Peris, E. *Organometallics*, **2011**, *30*, 5985.

  
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