Department of Chemistry

Departmental Seminar

You are cordially invited to a virtual lecture presented by

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Date: Friday, 12 August
Time: 10:30 – 11:20
Venue: **Orbital**
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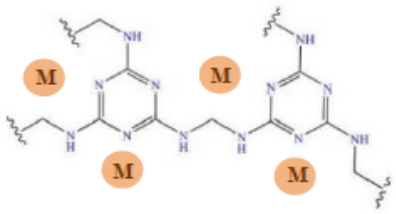
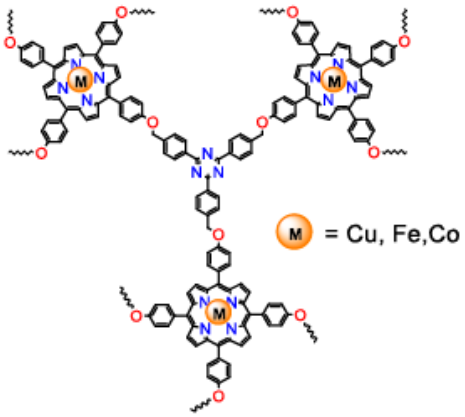
Catalytic alcohol oxidations using metals supported on triazine-based polymeric matrices

Alcohol oxidation is an important transformation to produce carbonyl compounds containing functionalities such as aldehyde and keto groups [1]. It is often one the most significant steps in the synthesis of fine chemicals, which are crucial building blocks in the production of pharmaceuticals, fragrances, flavouring additives, and biologically active agents. These transformations are usually mediated by homogeneous catalysts, but these come with some major drawbacks viz. catalyst instability as well as the difficulty of catalyst recovery and reuse. These problems can be addressed by supporting active catalysts on insoluble supports, allowing the catalysts to be recycled. Often the supports used, are inorganic in nature and includes materials such as silica, alumina, titania, zeolites and other oxides. However there has been increasing work done on employing insoluble organic polymers as support materials [2]. In this talk, I will discuss the use of triazine-based polymeric materials as nitrogen-rich catalyst supports. Two systems will be discussed viz. polymelamine formaldehyde (PMF)

micro spheres [3] as well triazine-based porous organic polymers (POPS). Examples of both of these types of polymers were decorated with transition metals to produce catalytically active materials. In the case of the PMF microspheres, these were decorated with gold and palladium nanoparticles, while in the case of POPS, the polymeric scaffold had porphyrin moieties incorporated into the polymer network. These porphyrin units were metallated with transition metals to produce heterogenized oxidation catalysts (Figure 1).



M@PMF microspheres (M= Pd and Au)



porphyrin -based POP.

Figure 1: Example of polymer supported oxidation catalysts.

The Au and Pd nanoparticles supported on PMF microspheres were employed and found to be active in the oxidation of benzyl alcohol and phenyl-substituted secondary alcohols giving good conversions and selectivities. The porphyrin-based POPs where evaluated in the oxidation veratryl alcohol and other lignin model compounds. A Cu decorated POP was found to be the most active, giving almost quantitative conversion using tertiary butyl hydrogen peroxide as oxidant. During this investigation it was discovered that selectivity to the preferred aldehyde product can be controlled by using ascorbic acid as modulator. This system was also found to be active in the oxidation of the bio-renewable substrate, 5-Hydroxymethyl-2-furaldehyde. Viable mechanistic pathways operative in both catalytic systems will also be presented in the talk.

References:

1. H. Sterckx, B. Morel, B. U. W. Maes *Angew. Chem. Int. Ed*. **58** (2019), , 7946 – 7970

2. N. Enjamuri, S. Sarkar, B. M. Reddy, J. Mondal, *Chem. Rec*. **19** (2019) 1782–1792

3. E. Storm, E.D. Maggott, R. Malgas-Enus, S.F. Mapolie, *J. Mol. Catal*. **528** (2022) 112456