University of Louisville
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Literature Seminar

When: October 13, 2020
Time: 2:30 PM
Location: Microsoft TEAMS

Metal Nanoparticles Incorporated into Hydrogels as Pseudo-Homogeneous Catalyst

Abstract

Nanosized metal particles exhibit properties that is entirely different from the bulk metal. Their small size coupled with high surface to volume ratio make them promising catalyst for reactions that includes C-C bond formation, hydrogenation, oxygen reduction, hydrogen evolution, oxygen evolution, carbon dioxide reduction, and others. Hydrogels are three-dimensional network of hydrophilic polymer in which a large amount of water is present. The first hydrogel was reported in 1960 by Wichterle and Lim.[1] The most characteristic properties of hydrogel is that it swells in the presence of water and shrinks in the absence of water. Solvated gels have great potential in catalysis as a result of the ability of small molecules to diffuse through them easily.[2] Incorporating metal nanoparticles into hydrogels can impart catalytic activity.[3] Reagents can diffuse into gels, products can diffuse out, and if catalyst is immobilized within the network, it can be potentially removed and reused.[4] Hydrogels can be considered intermediate between homogeneous and heterogeneous catalytic system, combining the advantage of both.[5] During the past 20 years, metal nanoparticle embedded into hydrogel has emerged as one of the most viable alternative to the traditional catalysis in various organic synthesis including coupling reactions.[6]

The first part of this presentation focusses on the background of catalysis, metal nanoparticles, and hydrogels. The recent advances in the field of hydrogels as a support for metal nanoparticle catalyst would be discussed.[6] Three different approached to incorporate metal nanoparticle into the hydrogel would be covered. The first approach for incorporating palladium nanoparticle would involve calcium alginate and dibenzylidene sorbitol (DBS) containing hydrogel.[2] The second approach involves incorporating gold nanoparticle into DNA hydrogel by reduction with sodium borohydride inside the gel .[7] The final approach to incorporate palladium nanoparticle into the hydrogel that involves tobacco mosaic virus (TMV) template. [3]

References:

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3. Sadehi, I.; Liu, E. Y.; Yi, H.; Asatekin A. *Appl. Nano Mater*. **2019**, *2*, 5233-5244.
4. Slavik, P.; Kurka, D. W.; Smith, D. K. *Chem. Sci.* **2018**, *9*, 8673-8681.
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6. Shokouhimehr. M. *et al*. *Appl. Nano Mater.* **2020**, *3*, 2070-2103.
7. Zinchenko, A. *et al*. *Appl Meter. Inte*r. **2014**, 6, *5*, 3226-3232.