Assignment-2

B. LAKSHMI PRIYANKA
CH20B060

1. Heterogenized homogeneous catalysts

Catalyst broadly are classified as homogeneous and heterogeneous catalyst. Homogeneous catalyst operate through the formation of intermediate compounds and heterogeneous catalyst operate by the adsorption of the reactants on the catalyst surface. Many homogeneous catalysts can be converted into heterogeneous ones, retaining the great activity and selectivity inherent in homogeneity and at the same time obtaining the ready recovery which is the great advantage of heterogenity. Many advantages have been found in the use of heterogenized homogeneous catalysts.

In an effort to aford its recoverability, homogeneous catalysts have been supported i.e, immobilized on solids, combining in this way the relative merits of the homogeneous and heterogeneous catalysis. The system is regarded as a heterogenized homogeneous catalyst and is sometimes referred to as 'hybrid catalyst'. Hybrid catalysts should contain metal complexes, or other catalytically active molecules, in a matrix; being, thus, heterogenous with respect to the reaction medium. The catalytically active molecule in such catalysts should ensure the advantages of homogeneous catalytic systems like : (a) high selectivity (b) feasible operation under mild conditions, (c) the possibility to obtain more reliable information on the type of active centers (d) the control of catalytic properties by means of changing its composition and eventually (e) asymmetric induction, while the application of matrices should ensure easy separation of catalysts from the reaction medium and higher stability.

The immobilized metal complexes are referred to be physically heterogeneous and chemically homogeneous catalysts. There are structurally different materials available for the immobilization of homogeneous catalysts. The most common are inorganic materials such as silica, mesoporous siliceous materials and zeolites.

The use of immobilized homogeneous catalysts offers a number of advantages but there are disadvantages as well. There is often metal complex leaching during the course of a reaction and the support can exert negative effects. Drawbacks can be reduced by a proper immobilization procedure and by suitable support properties. The heterogenization of homogeneous catalysts is currently an economical, but also a toxicological and environmental challenge.

2. Applications of ~~Ha~~ Ionic liquids in homogeneous catalysis.

Ionic liquids (ILs), salts with melting points below 100°C, represent a class of liquid materials typically characterized by an extremely low vapor pressure. Besides their application as new solvents or as electrolytes for electrochemical purposes, there are two important concepts of using ILs in catalysis: Liquid-liquid biphasic catalysis and IL thin film catalyses. Liquid liquid biphasic catalysis enables either a very efficient manner to apply catalytic ILs, e.g in Friedel-Crafts reactions, or to apply ionic transition metal catalyst solutions. In both the cases, phase separation after reaction allows an easy separation of reaction products and catalyst re-use. One problem of liquid liquid biphasic catalysis is mass transfer limitation. If the chemical reaction is much faster than the liquid liquid mass transfer the latter limits the overall reaction rate. This problem is overcome in IL thin film catalysis where diffusion pathways and the characteristic time of diffusion are short.

~~Ioni~~ Supported ionic liquid phase (SILP) and solid catalyst with Ionic liquid layer (SCILL) are the two most important concepts. In both, a high surface area solid substrate is covered with a thin IL film which contains either a homogeneously dissolved transition metal complex for SILP, or which modifies catalytically active surface sites at the support for SCILL.

For IL thin film catalysis, the interfaces of the IL with the gas phase and with catalytic nanoparticles or support materials are of critical importance.

3. <u>Continuous Homogeneous Catalysis.</u>

The recycling of homogeneous catalysts can be performed using different types of supports, such as dendrimers, hyperbranched polymers, nanostructured materials or stabilized nanoparticles in combination with suitable filtration methods and equipments. Continuous homogeneous catalysis is ideally performed in a continuously operated membrane reactor.

The activation of the C-H bond, a necessary step to get high-value added compounds is one of the most important issues in modern catalysis. Combining the advantages of both homogeneous and heterogeneous catalysis, a certain continuous homogeneous process is one of the ideal routes for the catalytic activation of C-H bonds.

Molecular weight enlargement (MWE) is an attractive method for homogeneous catalyst recycling. Applications of MWE in combination with either catalyst precipitation or nanofiltration have demonstrated their great potential as a method for process intensification in homogeneous catalysis.

Membrane filtration is an attractive approach for soluble catalyst recycling. Applications of nanofiltration have demonstrated their great potential as a method for process intensification in enzyme, organo and homogeneous catalysis, both in laboratory practice and on an industrial scale.