Conclusion and Future Outlook

In Conclusion, various new protocols for synthesis of metal oxide nanoparticles have been developed as a catalyst for different chemical transformations. In addition to these protocols several new catalytic applications of nanosize materials have been explored in different coupling and condensation reactions.

Initially, we have synthesized TiO_2 nanoparticles. $Ti(OH)_4$ precipitate was prepared by sol gel method and separated by using spray drier. These TiO_2 nanoparticles are successfully used for degradation of dichlorvos. We were encouraged by results obtained for synthesis of novel MgO/ZnO nanoparticles for degradation methyl orange and rhodamine b dyes.

We have synthesized powder ceria nanoparticles by ultrasonic assisted method. Further, we explored these ceria nanoparticles as an excellent catalyst for synthesis of α-aminophosphonates and O- and N- arylations. We had explored new catalytic activity of nanosize Pd/CeO_2 in the reduction of nitroaromatic compounds. We have also carried out synthesis of nanosize mixed metal oxides of zinc and cobalt metals. The catalytic activity of ZnO/Co_3O_4 was explored for synthesis of tetrazole molecules.

It has been observed from rapidly growing number of publications on catalysis by nanosize materials that "Nanocatalysis" is growing at surprising speed. Nanocatalysis resemble to homogeneous catalyst (high surface area, easily accessible) and heterogeneous catalyst (stable, easy to handle, easy to isolate) and it offers the advantages of both catalytic systems allowing chemical transformation at ambient reaction conditions. In spite of well demand in the case of nanoparticles catalysis, there are several limitations in its utility at industrial level.

Knowledge of the existing mechanisms at such nano scale catalysis is fairly sparse. Also there is lack of advent technology that will support the lab scale nanocatalysis for synthesis of complex molecules at industrial scale. Hence the further developments in nanocatalysis to trigger its different applications in

catalytic fields require interdisciplinary collaborations among chemists, engineers and material scientists.

Emphasis has to be given on to understand the mechanism at nanoscale level which include experiments on reaction kinetics, theoretical modelling, catalyst surface characterization, and validation of reaction intermediates. Although a large number of reports are coming on nanocatalysis, it has not been studied at its full potential. In future it is anticipated that, many new applications in catalyst by nanoparticles including bimetallic and hybrid systems will be explored. Similarly, we are optimistic that in future, there will be a development in mechanical study at nanoscale and advent technology which will make use of nanocatalysis feasible at industrial scale in different industries.