Peter R Makgwane et al., J Pet Environ Biotechnol 2014, 5:4
http://dx.doi.org/10.4172/2157-7463.S1.006

OMICS Group Conferences
Accelerating Scientific Discovery

2nd World Congress on
Petrochemistry and Chemical Engineering
October 27-29, 2014 Embassy Suites Las Vegas, USA

Highly active nano-dispersed Ruthenium catalyst for efficient oxidation of p-cymene and cumene C-H bond by molecular oxygen

Peter R Makgwane and Suprakas Sinha Ray
Council for Scientific Industrial Research, South Africa

Liquid-phase oxidation (LPO) of hydrocarbons inert C-H is of major industrial importance in the production of oxygenates. The challenge in these reactions is to attain improved process efficiency and products selectivity. In general, selectivity is in the trade-off to high conversions in the hydrocarbons LPO thus are restricted to low. In this presentation an efficient solvent-less liquid phase oxidation (LPO) process of p-cymene using green molecular oxygen as oxidant over supported ruthenium nanoparticles (Ru NPs) on different metal oxide supports (Hydrotalcite, CNFs, SnO_2, ZrO_2, WO_3, Al_2O_3 and MgO) into tertiary cymene hydroperoxide (TCHP) is reported. TCHP serves as an intermediate for the production of p-cresol. Supported Metal nanoparticles (MNPs) have recently received a great attention due to its high activity and stable metal structure in mediating several catalysed LPO reactions. The factors affecting the catalytic oxidation rates including, the role of the Ru catalyst in the reaction initiations, influence of the nature of metal oxide supports and amounts of reacting substrates were evaluated. The obtained catalytic performance results were correlated with the Ru NPs based catalysts structure characterization data. All the supported catalysts prepared by the same method showed the formation of well-dispersed Ru NPs with average diameter of less than 7 nm. The activity results of Ru NPs catalyst in p-cymene oxidation showed to depend on the nature of the metal oxide support used. More noticeable was the effect of metal oxide support was on products distribution. On oxidic supports Ru NPs showed to favor the formation p-cymene at the methyl group to yield primary cymene hydroperoxide (PCHP) with its corresponding derivatives as oppose to TCHP. The supported Ru NP catalyst also showed excellent catalytic activity of aerobic oxidation cumene to cumyl alcohol and cumyl hydro peroxide (CHP), the latter an intermediate to phenol. The results obtained demonstrated that other physico-chemical properties of the metal oxide supports (e.g. reducibility, acidic/basic, Ru-support interaction), rather than their surface areas are critical parameters that determine the catalytic performance of Ru NPs catalyst. The catalytic activity displayed by supported Ru NPs present encouraging results for ruthenium as a promising active catalyst for C-H activation in LPO of typical alkyl aromatic hydrocarbons such as p-cymene for selective introduction of oxygen atom.

Biography

Peter Makgwane has completed his PhD from Nelson Mandela Metropolitan University (NMMU) in 2009 and postdoctoral studies from both University of Johannesburg (2011-2012) and CSIR-South Africa (2013). He is currently a Senior Research Scientist at the DST-CSIR National Centre for Nao-structured Materials working on the development of green catalytic processes for efficient and sustainable organic chemical transformations. He has published a book chapter on interface of nanocatalysis and microfluidic flow reactions; guest edited a thematic issue on “Nanocatalysis” for Journal of Nanoscience and Nanotechnology and published 18 peer-reviewed articles in internation journals.

pmakgwane@csir.co.za