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Some possibilities of heterogeneous catalysis for the oxidation of cyclohexane

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The oxidation of cyclohexane, important in the production of the nylon monomers adipic acid, hexamethylene diamine and caprolactum, is one of those processes which, in spite of a tremedous amount of research effort, has resisted any substantial improvement in terms of the selectivities achieved. Industrial conversions have to be limited to about 4-8% in order that the selectivity to the primary products of alcohol and ketone (the mixture being known as KA-oil) does not suffer seriously. While soluble cobalt catalysts are commonly used in industry, environmental concerns and potential improvements have been powerful driving forces towards heterogenization. This talk reports on a new generation of synergistic, ketone-selective, cobalt-molybdenum mixed oxide catalysts, which provide a conversion of about 7.5% with a KA-oil selectivity of about 94%. The most promising of these catalysts, $CoMoO_4$-11 (with a Co:Mo ratio of 1:1), has been studied in detail and the kinetics modeled. The catalyst is deactivated at higher conversions by product adsorption, but the activity is completely restored on recalcination. Studies have also been carried out on supporting the catalyst particles on mesoporous silica supports to facilitate use in industrial processes, and the results with FDU-12 are particularly encouraging. An interesting feature of the catalyzed oxidation is the significant contribution of the uncatalyzed reaction, which at times makes for somewhat counter-intuitive trends.

Biography

Akkihebbal K Suresh completed his PhD from Monash University. After a brief stint with Hindustan Lever Research Centre (a Unilever company), he joined the Indian Institute of Technology Bombay in 1988 and has been with the Institute ever since. He currently holds an Institute Chair in the Department of Chemical Engineering. He served as the Head of the department from 2005-2008, and as the Dean of Faculty Affairs of IIT Bombay during 2009-2014. Apart from an abiding interest in liquid phase hydrocarbon oxidations, his work encompasses other themes in transport and reaction engineering. He is a Fellow of the Indian National Academy of Engineering.

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