DOI: 10.1002/adsc.2017((220b3cebb4f8a966); accepted

Preparation of MCM-22 / Hydrotalcite Framework Composite and Its Catalytic Application

Thangaraj Baskaran,[a] Jayaraj Christopher,[b] Mariyamuthu Mariyaselvakumar,[c] Ayyamperumal Sakthivel,* [a,d]

* [a] Department of Chemistry, School of Physical Sciences, Riverside Transit Campus, Central University of Kerala, Padnekkad, Kerala-671 314, India,

[b] Indian Oil Corporation Ltd, R&D Centre, Faridabad-121007, India,

[c] Inorganic Material and Catalysis Division, CSIR-CSMCRI, Bhavnagar-364002, Gujarat, India,

[d] Department of Chemistry, Inorganic Materials & Catalysis Laboratory, University of Delhi, Delhi-110007, India.

E-mail: sakthivelcuk@cukerala.ac.in / sakthiveldu@gmail.com

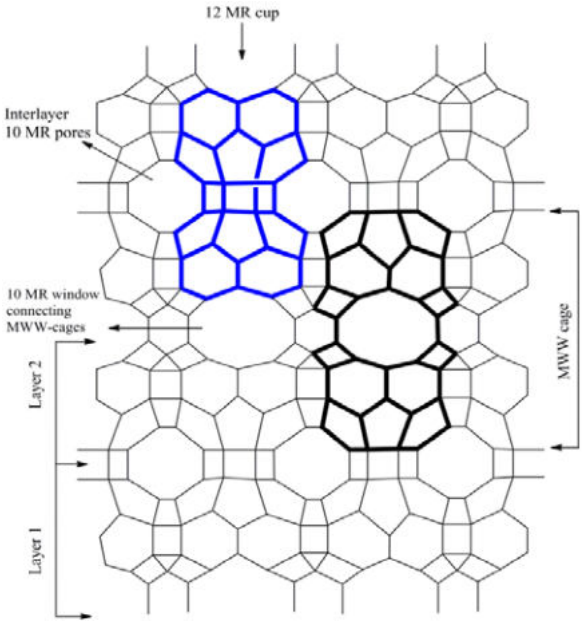
URL: http://cukerala.ac.in/index.php?option=com_content&view=article&id=274&Itemid=441&lang=en

ABSTRACT: A composite material (MAMCM) possessing both layered MgAl-hydrotalcite (HT) and MCM-22 was prepared by a simple co-precipitation method. The resulting composite material has features of both MCM-22 and the HT layered framework, as shown by powder XRD, FT-IR, ^{29}Si, ^{27}Al-MAS NMR, and SEM study. Electron microscopy revealed that layer sheets are arranged in a spherical morphology. The composite material was utilized for vapor phase alkylation of toluene. The MAMCM material showed better toluene conversion than MCM-22 and MA-HT materials.

Keywords: Layered Materials, zeolite, hydrotalcite, catalysts, toluene alkylation

Introduction

Zeolites and modified zeolites have been extensively used for various petrochemical processes[1-5] such as fluidized catalytic cracking,[5] alkylation of aromatics,[6] aromatization of hydrocarbon,[7] isomerization,[7] and also in other fields like drug delivery,[8] bio-sensor,[9] agriculture,[10] and adsorbents[11] etc. MCM-22 is an anionic framework zeolite material constituted of two non-intersecting pore systems with thin-plate morphology and possessing large amount of super-cages on the external packet (Scheme 1).[12-16] Among the various zeolites, ZSM-5 and MCM-22 are medium pore shown as promising shape selective catalysts for the selective preparation of *p*-xylene by various processes such as toluene alkylation, disproportionation of toluene and *m*-xylene isomerization etc.[17-20] In recent decades significant improvement was observed over C_8 selectivity on toluene alkylation through different processes such as dealumination, substitution of metal ions, impregnation of oxides and preparation of composites with MCM-22 or ZSM-5 materials etc.[21-24] The modification processes cover the external acidic sites and adjust the pore entrance of MCM-22 materials and reduce side reactions such as multi-alkylation and de-alkylation.[21-24]



Scheme 1. Schematic representation of MCM-22 structure.

On other hand, layered hydrotalcite (HT) materials have cationic framework with general formula $[M(II)_{(1-x)}M(III)_x(OH)_2]^{x+}[A^{n-}_{x/n}]mH_2O$,[25-27] yield a variety of tailor made materials and shown as potential catalyst,[28] catalytic supports[29, 30] and adsorbents[31] etc. In the HT materials the interlayer anions are exchangeable, giving rise to elegant intercalation chemistry. In this regards it is worth to mention here that recently, the