

## Accepted Article

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

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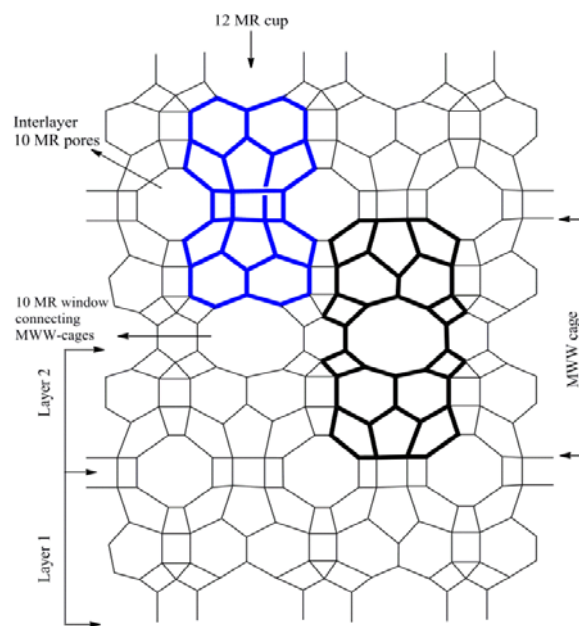
**ABSTRACT:** A composite material (MAMCM) possessing both layered MgAl-hydrotalcite (HT) and MCM-22 was prepared by a simple co-precipitation method. The resulting composite material has features of both MCM-22 and the HT layered framework, as shown by powder XRD, FT-IR, <sup>29</sup>Si, <sup>27</sup>Al-MAS 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<sup>[1-5]</sup> such as fluidized catalytic cracking,<sup>[5]</sup> alkylation of aromatics,<sup>[6]</sup> aromatization of hydrocarbon,<sup>[7]</sup> isomerization,<sup>[7]</sup> and also in other fields like drug delivery,<sup>[8]</sup> bio-sensor,<sup>[9]</sup> agriculture,<sup>[10]</sup> and adsorbents<sup>[11]</sup> 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).<sup>[12-16]</sup> 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,<sup>[17-20]</sup> disproportionation of toluene and *m*-xylene isomerization etc.<sup>[17-20]</sup> In recent decades significant improvement was observed over C<sub>8</sub> 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.<sup>[21-24]</sup> 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.<sup>[21-24]</sup>



**Scheme 1.** Schematic representation of MCM-22 structure.

On other hand, layered hydrotalcite (HT) materials have cationic framework with general formula  $[M(II)_{(1-x)}M(III)_x(OH)_2]^{x+}[A^{n-}_{x/n}]_mH_2O$ ,<sup>[25-27]</sup> yield a variety of tailor made materials and shown as potential catalyst,<sup>[28]</sup> catalytic supports<sup>[29, 30]</sup> and adsorbents<sup>[31]</sup> 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