

Title: Modification of MCM-22 zeolite through sequential post-synthesis treatments. Implications on the acidic and catalytic behaviour

Author(s): Machado, V. ^[1,2]; Rocha, J. ^[3,4]; Carvalho, A. P. ^[5,6]; Martins, A. ^[1,2]

Source: Applied Catalysis A-General **Volume:** 445 **Pages:** 329-338

DOI: 10.1016/j.apcata.2012.09.001 **Published:** Nov 28 2012

Document Type: Article

Language: English

Abstract: Desilication and a combination of alkaline followed by acid treatment were applied to MCM-22 zeolite using two different base concentrations. The samples were characterised by powder X-ray diffraction, Al-27 and Si-29 MAS-NMR spectroscopy, SEM, TEM and low temperature N₂ adsorption. The acidity of the samples was study through pyridine adsorption followed by FTIR spectroscopy and by the analyses of the hydroxyl region. The catalytic behaviour, anticipated by the effect of post-synthesis treatments on the acidity and space available inside the two internal pore systems was evaluated by using the model reaction of m-xylene transformation.

The generation of mesoporosity was achieved upon alkaline treatment with 0.05 M NaOH solution and practically no additional gain was obtained when the more concentrate solution, 0.1 M, was used. Instead, Al extraction takes place along with Si, as shown by Si-29 and Al-27 MAS-NMR data, followed by Al deposition as extraframework species.

Samples submitted to alkaline plus acid treatments present distinct behaviour. When the lowest NaOH solution was used no relevant effect was observed on the textural characteristics. Additionally, when the acid treatment was performed on an already fragilized MCM-22 structure, due to previous desilication with 0.1 M NaOH solution, the extraction of Al from both internal pore systems promotes their interconnection, evolving from a 2-D to a 3-D porous structure. This transformation has a marked effect in the catalytic behaviour, allowing an increase of m-xylene conversion as a consequence of an easier and faster molecular traffic in the 3-D structure. On the other hand, the continuous deposition of extraframework Al species inside the pores leads to a shape selective effect that privileges the formation of the more valuable isomer p-xylene. (C) 2012 Elsevier B.V. All rights reserved.

Author Keywords: MCM-22; Desilication; Acid treatment; Acidity; m-Xylene transformation

Keywords Plus: H-MCM-22 Zeolite; Pore Systems; Dealumination; Isomerization; Mechanisms; Diffusion; ZSM-5

Reprint Address: Carvalho, AP (reprint author) - Univ Lisbon, Fac Ciencias, Dept Quim & Bioquim, Campo Grande Ed C8, P-1749016 Lisbon, Portugal.

E-mail Addresses: ana.carvalho@fc.ul.pt; amartins@deq.isel.pt

Addresses:

[1] Inst Super Engn Lisboa, Area Dept Engn Quim, P-1959007 Lisbon, Portugal

[2] Inst Super Engn Lisboa, CIEQB, P-1959007 Lisbon, Portugal

[3] Univ Aveiro, Dept Quim, P-3810193 Aveiro, Portugal

[4] Univ Aveiro, CICECO, P-3810193 Aveiro, Portugal

[5] Univ Lisbon, Fac Ciencias, Dept Quim & Bioquim, P-1749016 Lisbon, Portugal

[6] Univ Lisbon, Fac Ciencias, CQB, P-1749016 Lisbon, Portugal

Funding:

Funding Agency	Grant Number
FCT (Portugal)	PEst-OE/QUI/UI0612/2011
	PEst-OE/EQB/UI0702/2011

Publisher: Elsevier Science BV

Publisher Address: PO Box 211, 1000 AE Amsterdam, Netherlands

ISSN: 0926-860X

Citation: MACHADO, V.; ROCHA, J.; CARVALHO, A. P.; MARTINS, A. - Modification of MCM-22 zeolite through sequential post-synthesis treatments. Implications on the acidic and catalytic behavior. Applied Catalysis A-General. ISSN 0926-860X. Vol. 445, (2012), p. 329-338.