**Additional Material Section**

**A New Route for the Synthesis of Self-Acidified and Granulated Mesoporous Alumina Catalyst with Superior Lewis Acidity and its Application in Cumene Conversion.**

**Mohsen. S. Mostafa,a,\*, Ahmed O. Abo El Naga,a Ahmed A. Galhoum,b Eric Guibal,c,\* Asmaa S. Morshedya,\***

a Refining Division, Egyptian Petroleum Research Institute, Nasr City, Cairo 11727, Egypt.

b Nuclear Materials Authority, P.O. Box 530, El-Maadi, Cairo, Egypt.

c IMT – Mines Ales, Centre des Matériaux des Mines d’Alès, Univ Montpellier, Alès, France.



**Figure AM1:** XRD diffraction pattern of mesoporous γ-alumina.



**Figure AM2:** SEM micrograph of the mesoporous γ-alumina (scale bar: 10 µm).

**Issues on the reproducibility of catalyst preparation and catalytic tests**

In order to verify the reproducibility of the manufacturing of the SAGMA catalyst a new batch of material was prepared and immediately testes for selected cumene conversion tests.

The main textural properties of the SAGMA produced in the second batch are reported below:

Specific surface area: 300 m2 g-1.

Pore volume 0.364 mL g-1

Pore diameter: 5.04 nm

This means that the new batch had a slightly higher specific surface higher (by 70 m2 g-1, about 30 % increase) a little lower pore volume (by 0.096 mL g-1; i.e., -22 %) while the average pore size was decreased from 7.8 nm to 5 nm.

Tables AM1 and AM2 are reporting the variability in catalytic performances.

**Table AM1:** Tests of cumene conversion at selected temperatures for LHSV: 2 h-1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Temperature | 150 °C | | 300 °C | | 350 °C | |
| Run # | 1 | 2 | 1 | 2 | 1 | 2 |
| Conversion (%) | 54.6 | 54.1 | 86.5 | 86.7 | 58.0 | 58.0 |
| Aver. Conv. (%) | 54.4 | | 86.6 | | 58.0 | |
| Δ (/ 1st batch) | +1.4 | | +1.6 | | +3.5 | |
| C1-C6 aliphatics | 3.3 (+1.3) | | 0.5 (+0.5) | | 7.2 (+2.5) | |
| Benzene | 49.1 (+0.1) | | 85.6 (+0.8) | | 41.5 (+0.5) | |
| Toluene | 0 | | 0.5 (+0.5) | | 1.4 (-0.1) | |
| Ethylbenzene | 2 | | 0 | | 7.9 (+0.6) | |

SAGMA catalyst: 1 g (40-60 Mesh (420-450 µm).

**Table AM2:** Tests of cumene conversion at selected temperatures for LHSV: 4 h-1.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Temperature | 150 °C | | 175 °C | | 200 °C | | 225 | | 250 | | 300 | | 350 | |
| Run # | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| Conversion (%) | 34.0 | 34.0 | 42.8 | 42.9 | 50.1 | 49.9 | 59.0 | 59.2 | 71.5 | 71.5 | 89.0 | 89.0 | 68.4 | 68.4 |
| Aver. Conv. (%) | 34.0 | | 42.9 | | 50.0 | | 59.1 | | 71.5 | | 89.0 | | 68.4 | |
| Δ (/ 1st batch) | +1.0 | | +0.9 | | 0 | | +1.1 | | +2.5 | | +1.9 | | +2.4 | |
| C1-C6 aliphatics | 7.6 (+3.6) | | 8.5 (+4.5) | | 9.6 (+3.6) | | 11 (+2) | | 14.8 (+2.4) | | 5.4 (+1.4) | | 16.3 (+0.6) | |
| Benzene | 11 (-13) | | 18.4 (-14) | | 21.8 (-8.2) | | 31 (-1) | | 39.1 (+21.8) | | 80.8 (+0.8) | | 33.6 (+2.6) | |
| Toluene | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 6.2 (+2.2) | |
| Ethylbenzene | 15.4 (+8.4) | | 16 (+10) | | 18.6 (+4.6) | | 17.1 (+0.1) | | 17.6 (-21.7) | | 2.8 (-0.3) | | 12.3 (-3) | |

SAGMA catalyst: 0.25 g (40-60 Mesh (420-450 µm), (into parenthesis: variation against 1st batch).