IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
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Industrial Consultancy & Sponsored Research (IC&SR)

METHOD FOR SYNTHESIZING HEXAGONAL AND CUBIC ORDERED MESOPOROUS γ-ALUMINA
IITM Technology Available for Licensing

Problem Statement

- In the present era, Alumina has tremendous applications in various fields of science viz. catalysis, sorption, separation, & the properties for which Alumina is well known as low electric conductivity, resistance to chemical attack, high strength, extreme harness & high melting point.
- In applications like catalysis, the absence of **uniform mesoporosity** in alumina can cause **sluggish diffusion** of the reactants which leads to **rapid deactivation of the catalyst** under **harsh reaction conditions.**
- **Therefore,** any significant advances in improving the **structural, textural** & **chemical properties** of **alumina** can find direct applications in industrial catalysis.
- Further a few non-patent literatures discussed regarding the synthesis of ordered mesoporous structure of alumina with a couple of **difficulties**, & **present invention** has addressed the issues in efficient manner.

Technology Category/ Market

Technology: Synthesis of ordered mesoporous γ-alumina (OMA);
Industry: Chemical Plant, Manufacturing.
Applications: Catalyst, Advanced Material.
Market: The global **catalyst** market is projected to **USD48.9B by 2030 &** grow at a **CAGR** of **5.6%** during forecast period of **2023 to 2030.**

Intellectual Property

IITM IDF Ref. 1857; IN Patent No.383658
PCT Application No. PCT/IN2020/050590

TRL (Technology Readiness Level)

TRL-4, Proof of Concept & validated in Lab

Research Lab

Prof. P. Selvam
NCCR & Department of Chemistry,

Technology

- Present invention describes a **method for synthesis of ordered mesoporous γ-alumina (OMA)** comprises a few steps explained in smart chart hereinbelow:

1. **Dissolving 0.5-4 g of amphiphilic substance in ethanol to form a solution;**
2. **Adding media to the solution under vigorous stirring; & adding 1.5-5.5g of aluminium iso-propoxide;**
3. **Continuous stirring at room temperature for 4-5 hours; & drying the obtained solution 50-80°C for 45-55hours; and**
4. **Calcination of the solids obtained at 550°C-750°C for 4-6hours in air.**

- The **media** is **acidic** & the **amphiphilic substance comprisenon-ionic surfactant**.
- The **synthesized** ordered **mesoporous γ-alumina** comprises each one of:

1. **Cubic-FCC (*Fm3m*) (MAA-108-F),**
2. **Cubic-BCC (*Im3m*) (MAA-108-B) and**
3. **Cubicgyroidal (*Ia3d*) (MAA-108-G) pore symmetries.**

- Said **acid-mediated** synthesis, the non-ionic surfactant comprises a **Pluronic (Poloxamer) F108.**
- The **acidic media** comprise **1.3-1.6 ml of 37 wt% HCL and 0.5g citric acid.**

CONTACT US
Dr. Dara Ajay, Head
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

Key Features / Value Proposition

❖ ***Technical Perspective:***

1. In the acid-mediated synthesis, the amphiphilic substance 0.75g of **Pluronic F108** dissolved in 20ml ethanol at 35°C, directs the self-assembly to form Fm3m symmetry **(MAA-108-F)** mesophase of ordered mesoporous γ-alumina(OMA).
2. Further, the amphiphilic substance 1.0-1.3g of Pluronic F108 dissolved in 20ml ethanol at 35°C, directs the self-assembly to form Im3m symmetry (**MAA-108-B**) mesophase of ordered mesoporous γ-alumina (OMA).
3. Moreover, the amphiphilic substance 1.7g of Pluronic F108 dissolved in 20ml ethanol at 35°C, directs the self-assembly to form gyroidal Ia3d symmetry (**MAA-108-G**) mesophase of ordered mesoporous γ-alumina (OMA)

❖ ***Industrial Perspective:***

1. The **mesoporous alumina** obtained by the method have direct advantages in **enhancing catalytic stability, diffusion properties & cost-effective.**

Technology with Experimental Results

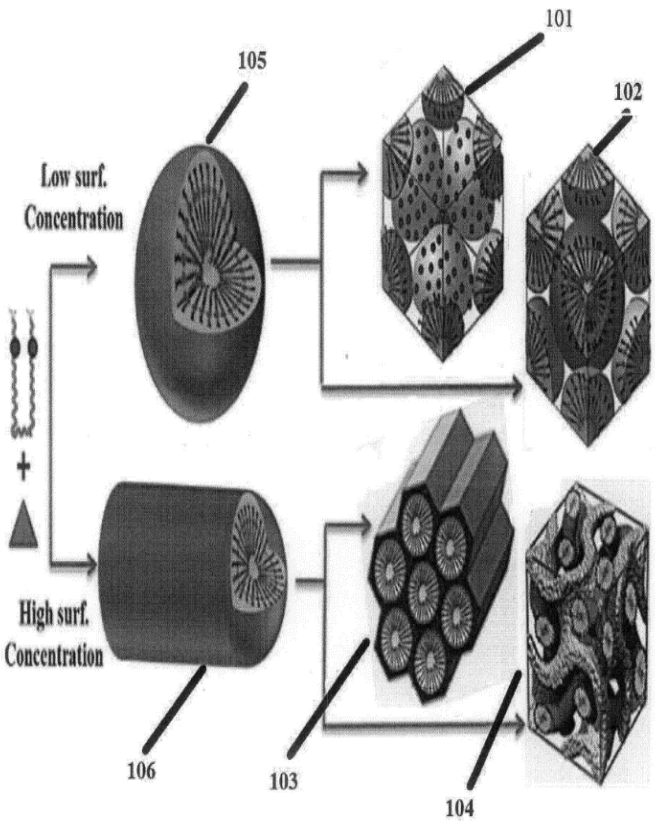

FIG.1: Illustrates the F108-spherical (105), cylindrical (106) micellar templates & the resulting Fm3m (101), Im3m (102), P6m (103) & Ia3d (104) pore symmetries respectively.

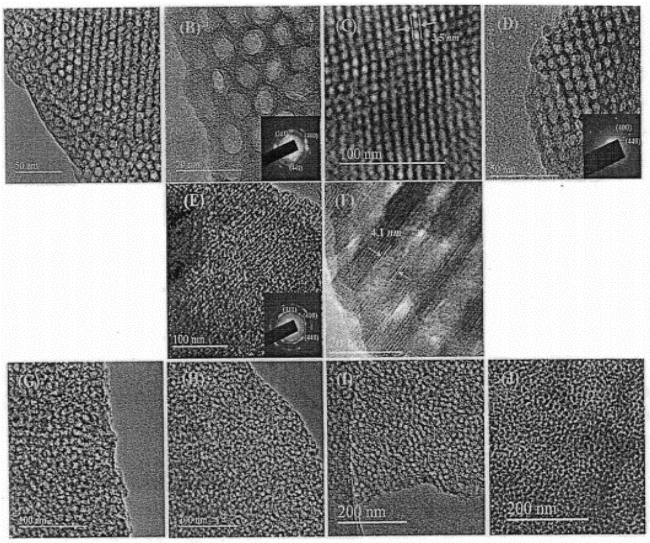

FIG.2 : Illustrates TEM images of MAA-108-F(A,B), MAA-108-B(C,D); MAA-016(E,F), MAA-108-H(G), MAA-108-G(H), MAA-123(I). MAA-127(J).

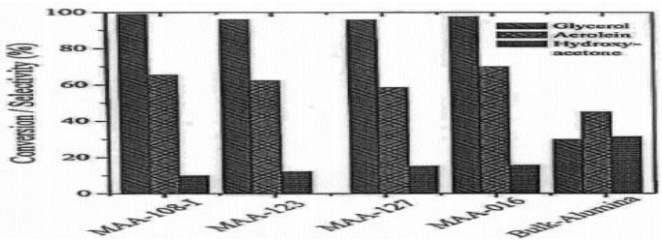

FIG.3, Depicts catalytic activity of various γ-alumina samples in glycerol dehydration.

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IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719