



**ORDERED AND HIERARCHICALLY POROUS ZEOLITE CRYSTAL AND
A METHOD FOR PREPARATION**

IITM Technology Available for Licensing

Problem Statement

- Improved zeolite catalysts have a huge demand for **selective butylation of phenol** with high conversion rates.
- A process to prepare hierarchical mesoporous zeolites with **varying micro- and mesoporosities using organosilane templates** with an ordered mesoporous structure is achieved.
- There remains a need to develop zeolites with ordered mesoporous structures and enhanced catalytic activity.
- Further, there exists a need for **synthesizing a cost-effective catalyst that displays enhanced selectivity toward the conversion of phenol.**

Technology Category/ Market

Category - Chemistry and Chemical Analysis

Applications - Manufacturing/Chemical, Catalysts, Mesoporous zeolite, Hierarchical nanoporous zeolites, Solid acid catalysts

Industry - Refining, Separation, and fine chemical synthesis

Market - The global zeolite market size was USD 8.5 B in 2022. It is projected to surpass around USD 12.7 B by 2032, and it is poised to reach a **CAGR of 4.2%** from 2023 to 2032.

Key Features / Value Proposition

- The **concept of stable supramolecular aggregation and slow rate of crystallization** is supported by low-temperature synthetic conditions, resulting in the formation of hierarchical organization.
- The invention also presents the remarkable activities of synthesized zeolites for tertiary butylation of phenol with enhanced selectivity towards 4-*t*-butylphenol and 2,4-di-*t*-butylphenol under optimized reaction conditions.
- The LTA- type zeolite has a wide range of applications in industries for example for use in **adsorption, separation, and ion-exchange** processes.

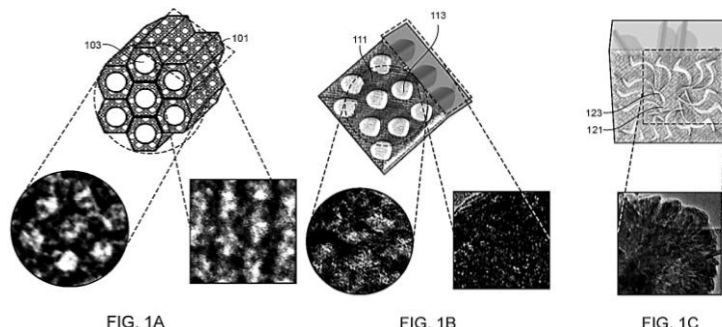


FIG. 1A depicts a MFI- type zeolite.
FIG. 1B depicts a FAU-type zeolite.
FIG. 1C depicts a LTA-type zeolite.

Intellectual Property

- IITM IDF Ref. 1587
- IN 341205 - Patent Granted
- PCT/IN2019/050202 - Published

Technology

- The present invention relates to an **ordered and hierarchically porous zeolite crystal catalyst showing enhanced selectivity towards phenol conversion** and a method for the preparation of the catalyst is disclosed.
- A solution containing **alumina, silica, and organosilane is mixed and treated at a particular temperature** for a particular period of time under pre-determined conditions to obtain a highly crystalline zeolite.
- The MFI-type (Fig.1A, 2A, 2B), FAU-type (1B, 3A, 3B), and LTA-type (1C; 3A, 3B) zeolite catalysts obtained exhibit hierarchical porous structures with ordered micro- and meso-pores.
- The surface area of the hierarchical zeolites are in the range of **95-620 m²g⁻¹** and the size of the mesopores is in the range of **3.0-6.4 nm**.
- The lifetime of the crystal is at least 20 h.**

TRL (Technology Readiness Level)

TRL – 4: Technology Validated in Laboratory

Research Laboratory

Prof. P. Selvam, NCCR & Dept. of Chemistry

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@iimail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

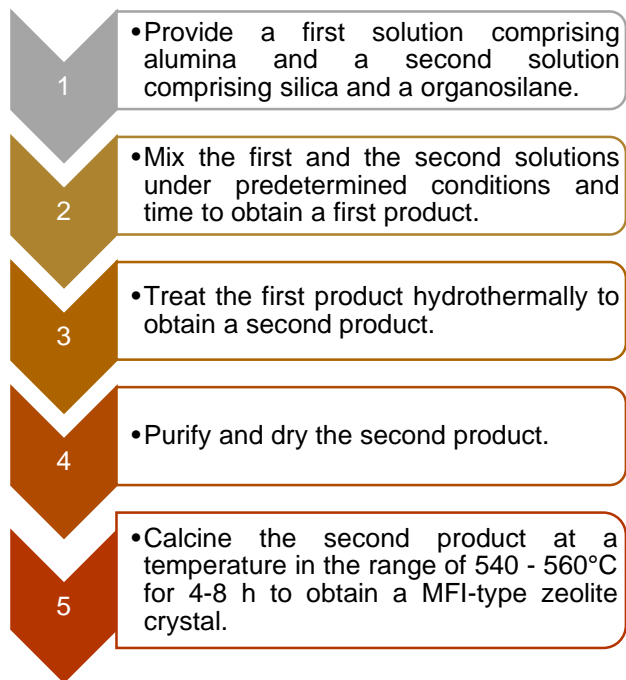


FIG. 2A

FIG. 2A depicts a method of preparation of MFI-type zeolite.

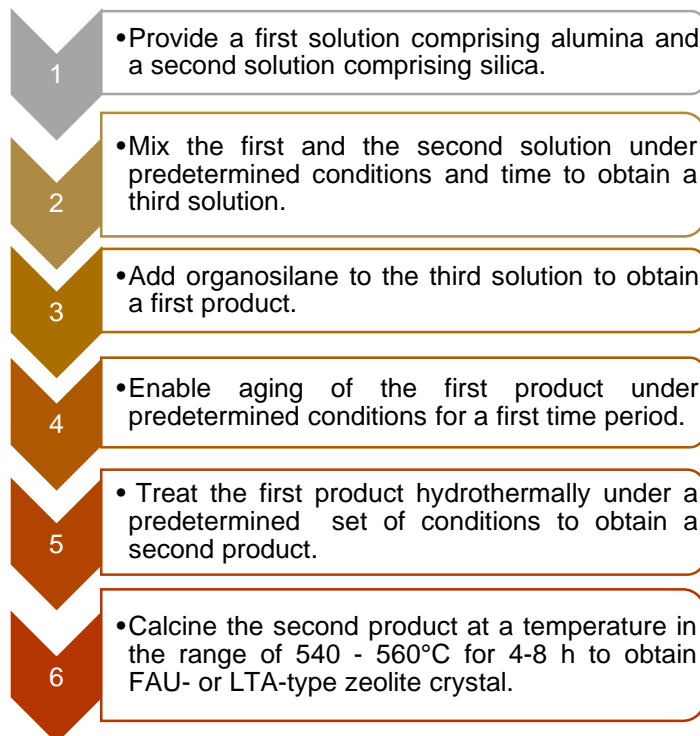


FIG. 3A

FIG. 3A depicts a method of preparation of FAU- or LTA-type zeolite.

FIG. 2B illustrates a reaction flow to obtain ZH-5.

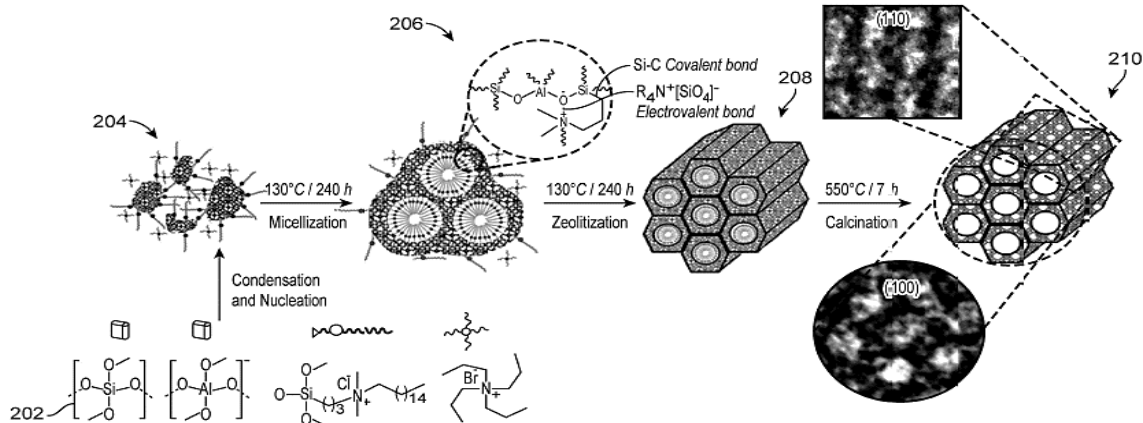


FIG. 2B

FIG. 3B illustrates a reaction flow to obtain LTA- and FAU- type zeolites.

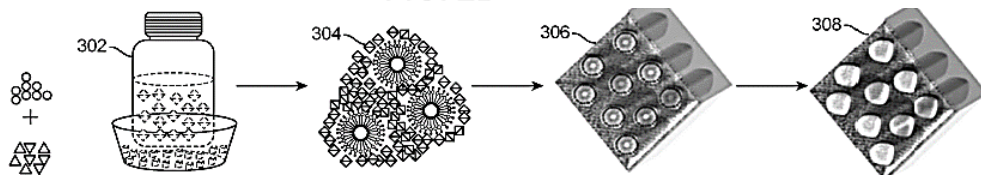


FIG. 3B

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@icsrps.iitm.ac.in
sm-marketing@iimail.iitm.ac.in

Phone: +91-44-2257 9756 / 9719