IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO - IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

WELL-ORDERED MESOPOROUS TITANIA (TMF-108) WITH BRONZE AND ANATASE PHASES AND PROCESS FOR ITS PREPARATION THEREOF

IITM Technology Available for Licensing

Problem Statement

- Generally, for synthesizing high quality ordered mesoporous materials, the high reactivity of titania precursor during hydrolysis leads to **uncontrolled phase separation between surfactant template and precursor**, therefore normally results in **disordered framework.**
- Further, preparation of these materials **encounters collapse of ordered mesoporous framework upon removal of the surfactant on calcination.**

Technology Category/ Market

Category – **Advance Materials and Manufacturing**
Applications –Catalysis, Paints, Diagnostics, Cosmetics Drug Delivery Systems,
Industry- Nanotechnology, Chemicals, Manufacturing, Healthcare
Market -The global **microporous and mesoporous** materials market size was **USD 8,601.7million in 2021**. The market is projected to touch **USD 14,930 million** by 2028 exhibiting a **CAGR of 8.2%** during the forecast period.

Key Features / Value Proposition

Technical Perspective:

- **Unique combination of anatase and TiO_2(B) mixed phases having high surface area, wide pore size distribution, and thick pore walls**
- The **optimum precursor/surfactant ratio** is a key to form thicker pore walls which gives stability to framework and **prevents collapse of mesoporous structure during surfactant removal**.

User Perspective:

- TMF-108 can be used for photocatalytic **dehydrogenation** of **ethanol** and several other **photocatalytic and photovoltaic application**

Technology

- The present invention discloses semiconductor material that includes **preparation of Well-ordered Mesoporous Titania (TMF-108) with Anatase and Titania-B (TiO_2(B)) mixed phases.**

METHOD:

Dissolving 0.274 mmol (4 g) F-108 triblock copolymer in 0.684 mol (40 mL) ethanol and stirring for 2 hours to obtain a homogenous solution

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Adding drops of 0.115 mol (16 mL) $TiCl_4$ (1 M in methylene chloride) under uniform stirring for 2 hours to obtain a clear solution(Molar ratio of $TiCl_4$/F108/Ethanol =1:0.0023:5.94)

↓

Pouring the resultant onto petri dish with uniform thickness and solvent is evaporated in an oven (40°C for , 7 days) where inorganic precursor hydrolyses and polymerized into a metal oxide framework

↓

Calcining the resultant at 360°C for 4 h in air at 0.5°C/min to remove the surfactant and obtain **well-ordered mesoporous TiO_2 (TMF-108)**

Image

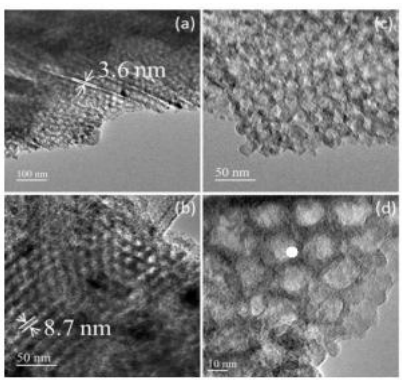

Fig.1(a), (b), (c) and (d) shows SEM images of **TMF108**

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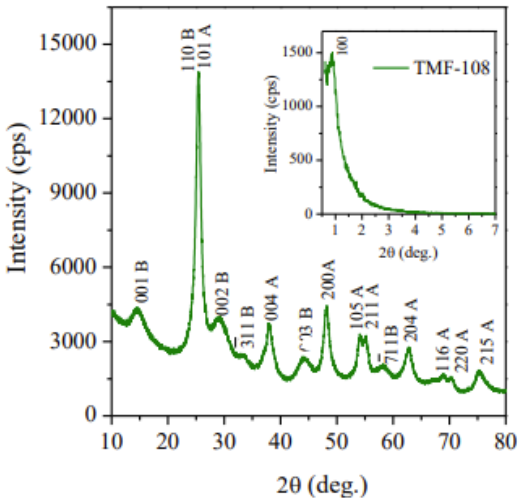

Fig.2 is the graphical representation of XRD patterns of TMF-108.

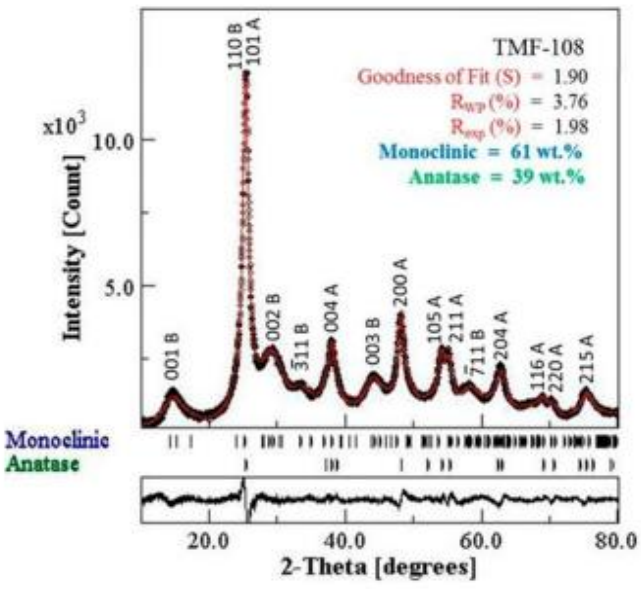

Fig.3 is the graphical representation of Rietveld refined XRD pattern of TMF-108.

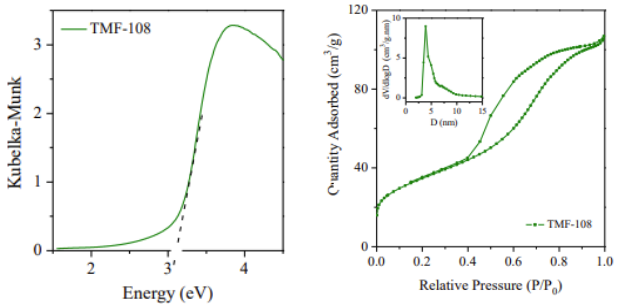

Fig.4 is the graphical representation of Kubelka-Munk plot of TMF-108. **Fig.5** is the graphical representation of N_2 sorption isotherm and pore size distribution (inset) of TMF-108.

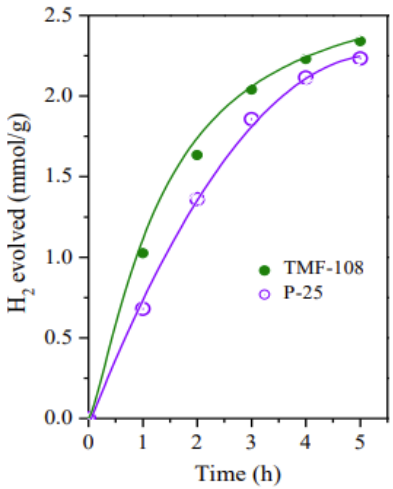

Fig.6 is the graphical representation of Photo-catalytic activity for hydrogen evolution reaction using TMF-108.

Intellectual Property

- **IITM IDF Ref. 1636**
- **IN377552(Granted)**

TRL (Technology Readiness Level)

TRL- 4,Technology Validated the lab

Research Lab

Prof. Selvam . P
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