



### AAO TEMPLATE-ASSISTED SYNTHESIS PROCESS COUPLED WITH ALKALI ETCHING TO DEVELOP ZINC OXIDE BRANCHED SUPERSTRUCTURES

#### IITM Technology Available for Licensing

#### Problem Statement

- In the prior arts, patent and non patent literature, there are few processes discussed for production of zinc oxide superstructures which incur **high initial equipment cost & requires modifiers, seed layers, or surface directing agents** which can compromise the purity of the developed nanostructures.
- Further, the above prior art techniques require **variety of organic or inorganic ingredients with time-consuming processing steps**, including heat treatment. Hence, there is a requirement of a simple process to address the above issues efficiently.

#### Technology Category/ Market

**Technology:** Zinc Oxide branched superstructures

**Industry:** Chemical, Renewable energy, Pharmaceutical

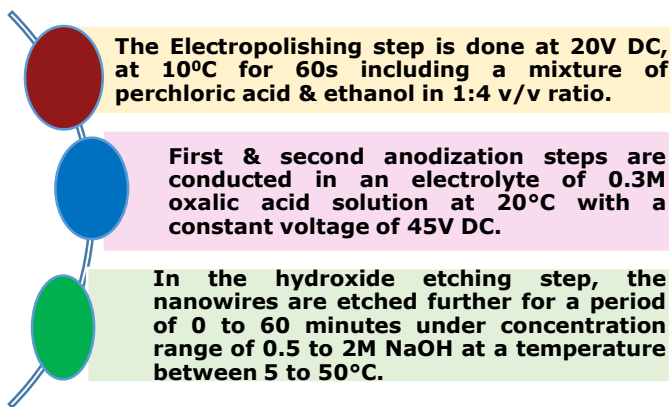
**Applications:** Catalysis, Sensing, Electronics

**Market:** The global nano zinc oxide market was valued at \$0.3 billion in 2021, projected to reach **\$1.1 billion** by **2031**, growing at a CAGR of **13.2%** from **2022** to **2031**.

#### Technology

- Patent literature talks about a process of preparation of zinc oxide (ZnO) superstructures by coupling anodic aluminum oxide (AAO) template-assisted synthesis with alkali etching, wherein the process comprises a steps of,
- Electropolishing ultrasonically** cleaned aluminium strips;
- Conducting **first anodization for 1 hour**;
- Oxide etching at 60°C for 1 hour**;
- Conducting **second anodization for 2 hours**;
- Thinning the **alumina dielectric barrier layer** by sequentially reducing the anodization voltage;

- Etching the **sample in 5 wt. % phosphoric acid at 20°C for 45 min to widen the pores**;
  - Electrochemical deposition of **zinc oxide (ZnO) nanowires within the AAO nanochannels**;
  - Hydroxide etching of ZnO nanowires embedded in the AAO template to **obtain ZnO superstructures**.
- ❖ Further, talks about various features for **obtaining ZnO superstructure** shown in smart chart:



- ❖ In this instant, the process of obtaining **ZnO superstructure** along with outcomes are depicted in the figures.

#### Intellectual Property

**IITM IDF Ref. 2249;**

**IN Patent No: 421576 (Granted)**

#### TRL (Technology Readiness Level)

**TRL- 4**, Proof of Concept ready & validated

#### Research Lab

**Prof. Lakshman Neelakantan,**  
**Prof. Parasuraman Swaminathan**

Dept. of Metallurgical & Materials Engineering, IIT Madras

#### 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](mailto:smipm-icsr@icsrpis.iitm.ac.in)

[sm-marketing@imail.iitm.ac.in](mailto:sm-marketing@imail.iitm.ac.in)

Phone: +91-44-2257 9756/ 9719

### AAO TEMPLATE-ASSISTED SYNTHESIS PROCESS COUPLED WITH ALKALI ETCHING TO DEVELOP ZINC OXIDE BRANCHED SUPERSTRUCTURES

**IITM Technology Available for Licensing**

#### Key Features / Value Proposition

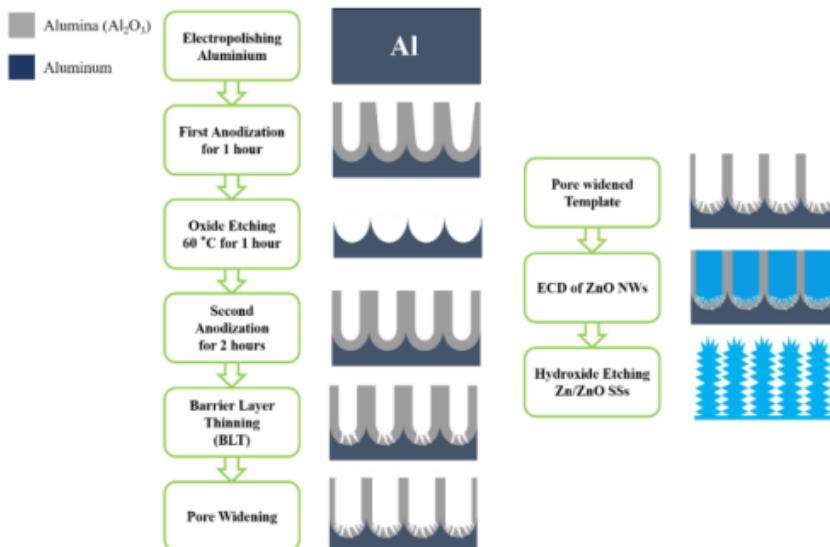
##### ❖ **Technical Perspective:**

1. Claimed Patent provides **simple fabrication process** to develop zinc oxide (ZnO) superstructures, by coupling anodic aluminum oxide template-assisted synthesis with alkali etching.

##### ❖ **Industrial Perspective:**

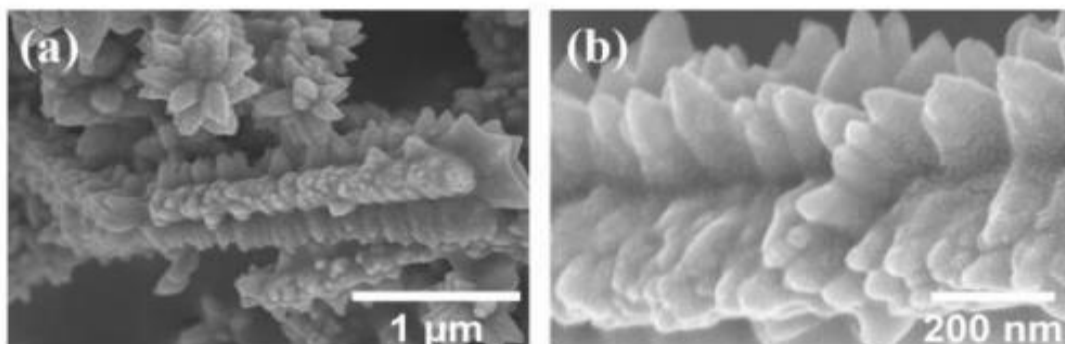
1. Patented Process is **cost-effective, less time taking, scalable technique** to grow zinc oxide (ZnO) SSs with fine tunable morphologies and modifier/catalysts/seed layers free.

#### Images



**Fig. 1: Illustrates a schematic representation of the series of steps involved in the development of ZnO SSs through AAO template assisted technique coupled with alkali etching;**

**Obtained ZnO superstructure**



**Figs. 2a & 2b: Illustrate zinc oxide SSs developed just after AAO template dissolution during alkali etching at room temperature;**

#### 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](mailto:smipm-icsr@icsrpis.iitm.ac.in)

[sm-marketing@imail.iitm.ac.in](mailto:sm-marketing@imail.iitm.ac.in)

Phone: +91-44-2257 9756/ 9719