

A METHOD FOR FABRICATION OF METALLIC NANOWIRES BY GALVANIC DISPLACEMENT REACTION USING AAO TEMPLATES

IITM Technology Available for Licensing

Problem Statement

- **Electrodeposition** of nano-wires on to Anodic Aluminum Oxide (AAO) **needs the application of (AC/DC) current using power source or potentiostat** to favour the **metallic deposition**.
- **Expensive noble metals** required in counter electrodes (Eg: platinum, gold).
- There is a need for the development of a fabrication method to synthesize nanowires that **is simple and does not use electricity or expensive reagents**.

Intellectual Property

- IITM IDF Ref. 1815
- IN 373659- Patent Granted

TRL (Technology Readiness Level)

TRL - 4: Technology validated in lab scale.

Technology Category/ Market

Category-

Micro & Nano Technologies

Industry Classification:

- **NIC (2008)- 24201-** Manufacture of Copper from ore, and other copper products and alloys; **28222-** Manufacture of electroplating machinery; **23101-** Manufacture of glass in primary or semi-manufactured forms; **26102-** Manufacture of electron tubes, diodes, transistors and related discrete devices
- **NAICS (2022)- 331420-** Copper Rolling, Drawing, Extruding, and Alloying; **332813-** Electroplating, Plating, Polishing, Anodizing, and Coloring; **334413** Semiconductor and Related Device Manufacturing **3272-** Glass and Glass Product Manufacturing;

Applications- Nanowire for catalysis for environmental and energy applications, electrochromic windows, photo voltaic Cells

Market -

Global Copper Nanowire market was valued at US\$ 47 million in 2023 and is anticipated to reach US\$ 74 million by 2030, witnessing a CAGR of 6.7% during the forecast period 2024-2030

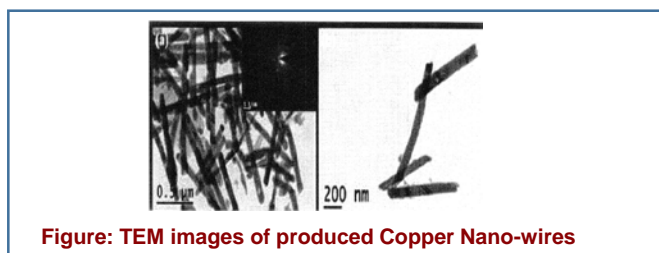
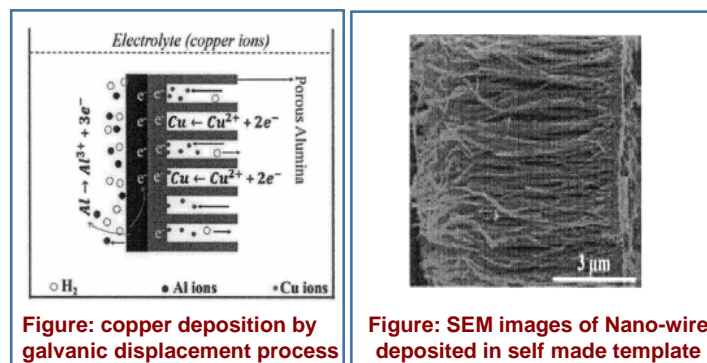
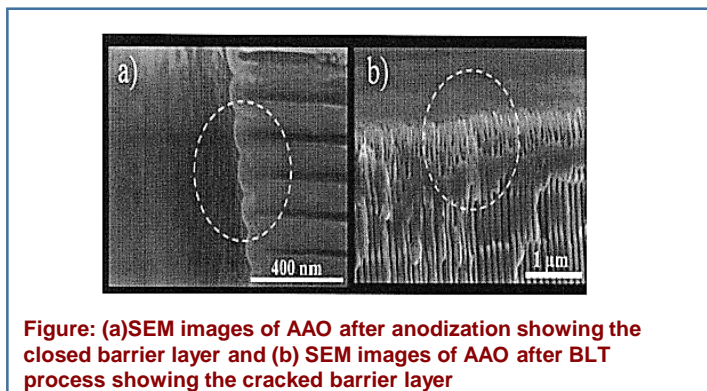
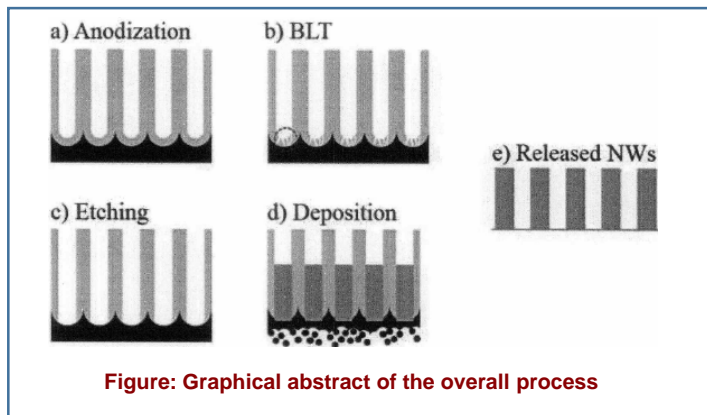
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Technology

- 1 A method for fabrication of metallic nanowires using Anodic Aluminum oxide (AAO) templates, by galvanic displacement reaction.
- 2 AAO templates were prepared by using two anodization processes followed by Boundary Layer Thinning (BLT).
- 3 Copper nanowires were deposited in the prepared AAO template using Galvanic displacement reaction.
- 4 Copper nanowire obtained were 73 nm in diameter with average length of 5-7 μm

Key Features / Value Proposition

- Method involves less steps for fabrication; while being faster and less expensive as it does not involve expensive equipment or reagents.
- The BLT method used for removal of barrier layer is an easier method to get uniform pores in the AAO for electrodeposition compared to conventional etching processes that require careful control of immersion time to avoid excessive porosity or destruction of template
- As size and aspect ratio of nanoparticles significantly impact their properties, the uniformity in the diameter of the fabricated nanowires makes it reliable in high performance applications.
- The process can be adapted to produce both pure metal and alloy nanowires based on the displacement galvanic reaction.
- Method comprises an appropriate combination of process parameters identified for the preparation of anodic aluminum oxide template without removal of the bare aluminum thus enhancing economy of the process compared to conventional processes.

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