



Vertical Growth of Nanoparticles Leading to Micrometer Long Brushes by Ambient Electrolytic Spray Deposition IITM Technology Available for Licensing

PROBLEM STATEMENT

- **Chemical vapour deposition** is a crucial process for controlled growth of **aligned and unprotected nanostructures**, particularly in thin film materials like graphene.
- **Studies have focused on the block-by-block growth of single-crystalline Si/Si-Ge superlattice nanowires, carbon nanotubes, and oriented long single-crystalline Si/Si-Ge superlattice nanowires.**
- **The research on one-dimensional nanostructures, including walled carbon nanotubes, Germanium nanowires, core-shell nanostructures, and one-dimensional structures of protected panicles.**

TECHNOLOGY CATEGORY MARKET

Technology: Vertical Growth of Nanoparticles Ambient Electrolytic Spray Deposition

Category: Micro & Nano Technologies

Industry: Biomedical, Environmental

Application: Nanotechnology applications, such as sensing, imaging, biology, and medicine

Market: The global market size was estimated at **USD 3.69 billion in 2022** and is expected to grow at a compound annual growth rate (CAGR) of **33.1% from 2023 to 2030**

INTELLECTUAL PROPERTY

IITM IDF Ref. 1267

Patent No: IN 413067

TRL (Technology Readiness Level)

TRL-3, Experimental proof of concept

Research Lab

Prof. Pradeep T, Dept. of Chemistry

TECHNOLOGY

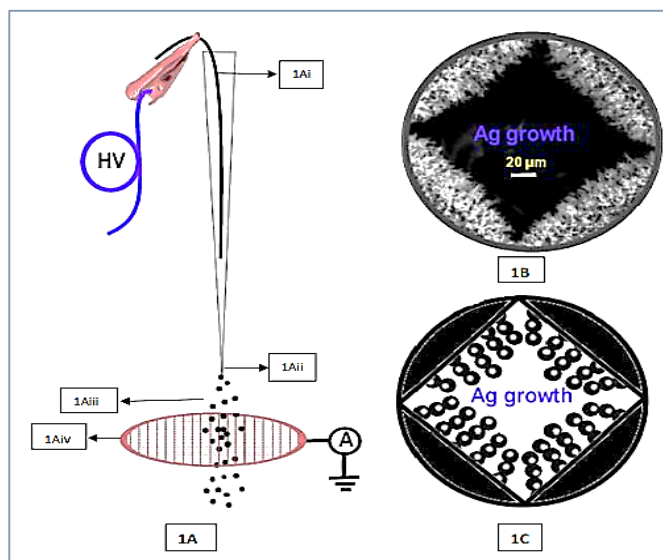
i). An electrolytic spray emitter (1Aii), with a silver metal wire (1Ai) fitted to a nanoelectrospray ion source serving as an anode and dry acetonitrile (ACN) or other non-aqueous solvent serving as the spray solvent;

ii). A copper clip that connects the silver wire to a high voltage power supply to apply an electric potential up to 1.5 kV to eject a plume of solvated silver ions (1Aiii);

iii). A transmission electron microscopy (TEM) grid substrate (1Aiv) serving as mask between the emitter and the collector surface to mask the ejected plume of solvated silver ions;

The growth occurs on the square-shaped patterns of the grid and accumulation of nanoparticles on the substrate results in one dimensional vertically oriented assembly of brush-like metal nanostructures.

1A) Schematic of the electrolytic deposition process, 1B) FESEM image, 1C) Schematic of the growth showing head on conical-like growth of AgNPs



CONTACT US

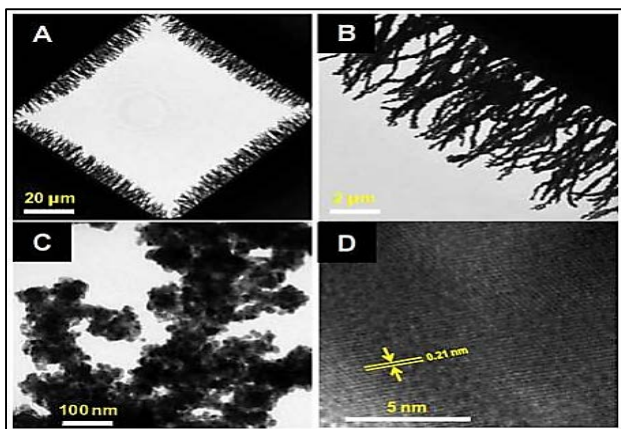
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A), B), and C) TEM images AgNPs, D) HR TEM of the same



A) TEM image of an empty TEM grid, B) SEM image of AgNPs, C) Raman image of a Ag brush, D) SEM image of an Ag brush

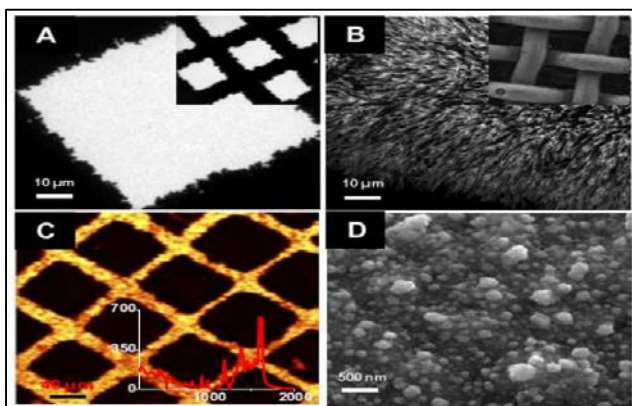
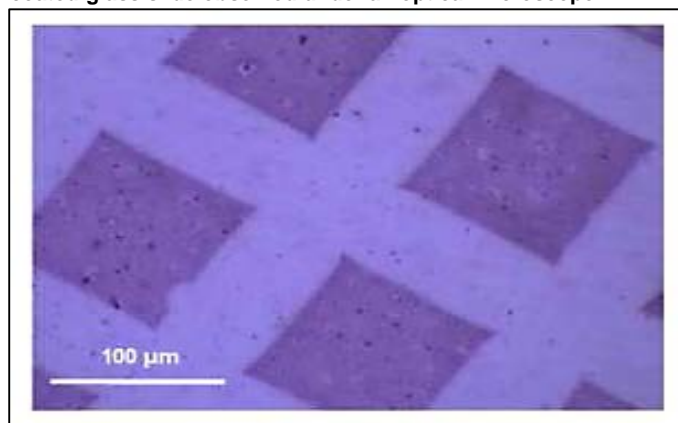
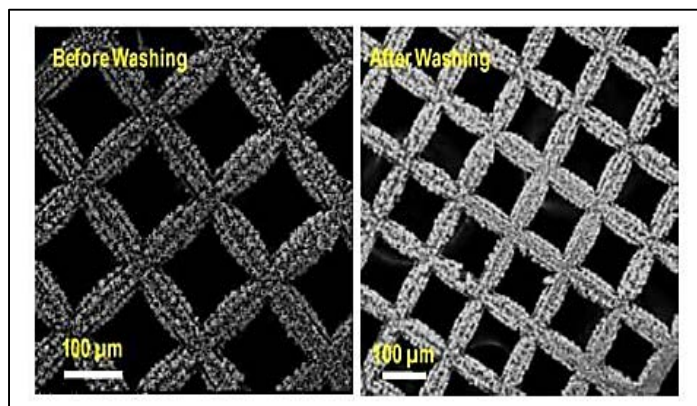


Illustration of patterned nanoparticle accumulation on ITO coated-glass slide observed under an optical microscope



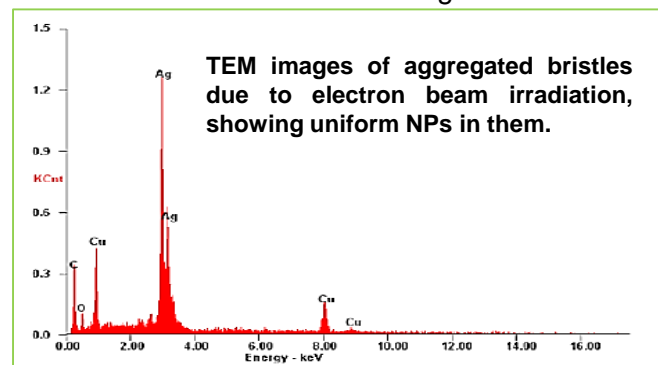
SEM images of a TEM grid with Ag growth on it, before and after water wash. The sample was made by 10 h electro spray deposition and it was washed with water gently for 30 min.



Key Features / Value Proposition

- **Metal 1D Nanostructures Growth**
 - Electrolytic spray deposition of metal wires.
 - Electro spray deposition of metal salts on grid substrates.
- **Metal wire:** silver wire
- **Metal salts:** silver acetate and palladium acetate
- **Deposition Substrates Method**
 - TEM grid, copper grid, nickel grid.
 - Stainless steel wire mesh.
- **"Metal 1D Nanostructures Capture Air Contaminants"**
 - Uses micrometer-long brushes.
 - Captures various air contaminants and particles.

- **Raman Spectroscopy for Contaminant Detection**
 - Utilizes high enhancement factor of nanostructured brushes.
- **Metal 1D Nanostructures Stability**
 - Utilizes micrometer long brushes.



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