



Industrial Consultancy & Sponsored Research (IC&SR)

METHOD AND APPARATUS FOR SYNTHESIZING IN-SITU MULTI-METALLIC NANOPARTICLES THROUGH POLARITY SWITCHING IN PULSED EROSION MACHINING PROCESS

IITM Technology Available for Licensing

PROBLEM STATEMENT

- Generation of mono and multi-metallic nanoparticles is one of the significant works ongoing in the field of nanotechnology.
- There are many methods involved in generation of nano particles, however, it has reported that those process involved **high investment costs, difficulty in vacuum maintenance, high power consumption and low yield rate.**
- Therefore, there is a requirement to address above issues in efficient manner.

TECHNOLOGY CATEGORY/ MARKET

Technology: Metallic Nanoparticles;

Industry: Manufacturing, Pharmaceutical, Electronics, Catalyst, Personal Care & Cosmetics

Applications: Pharmaceutical & Healthcare, Electronics, Catalyst, & Cosmetics

Market: The global **metal nanoparticles** market was estimated at USD 2.4B in 2021 and projected to grow **USD 6.39B** at a **CAGR of 11.66%** during the forecast period from **2022 to 2030.**

TECHNOLOGY

- Patent literature describe about a method of synthesizing in-situ multi-metallic nanoparticles through polarity switching in pulsed erosion machining process.
- Further the patent is described about an apparatus for generating multi-metallic nanoparticles described in smart-chart and exemplary figures.
- The apparatus comprises of multi-tool electrodes and twin-head tool with two different tool holding chuck.

To generate multi-metallic nanoparticles, the stepper motor-controlled Z-axis feeding is designed to feed the multi-pin electrodes to produce nanoparticles. The smart-chart shows the process as claimed.

First step describes about submerging a tool electrode & workpiece electrode separated by inter-electrode gap in the dielectric fluid;

Second step describes about ionization of dielectric fluid by employing potential difference between a tool electrode & workpiece electrode to generate spark discharge to remove the material;

Third step describes about quenching the evaporated metallic material in dielectric fluid leading to the rapid dispersion of ions.

KEY FEATURES / VALUE PROPOSITION

- ❖ **Technical Perspective:** High yield of multi-metallic nanoparticles using, multi tool electrodes & twin head mechanism;
- ❖ **Industrial Perspective:**
 - Particles generated by the pulsed erosion method are **pure & defect-free, cost-effective, increases the yield;**
 - Patented method generates the **heterogeneous silver-gold-multi-metallic nanoparticles.**

INTELLECTUAL PROPERTY

IITM IDF Ref. 2334;

IN Patent No: 422530 (Granted)

TRL (TECHNOLOGY READINESS LEVEL)

TRL- 3, Proof of Concept ready & validated

RESEARCH LAB

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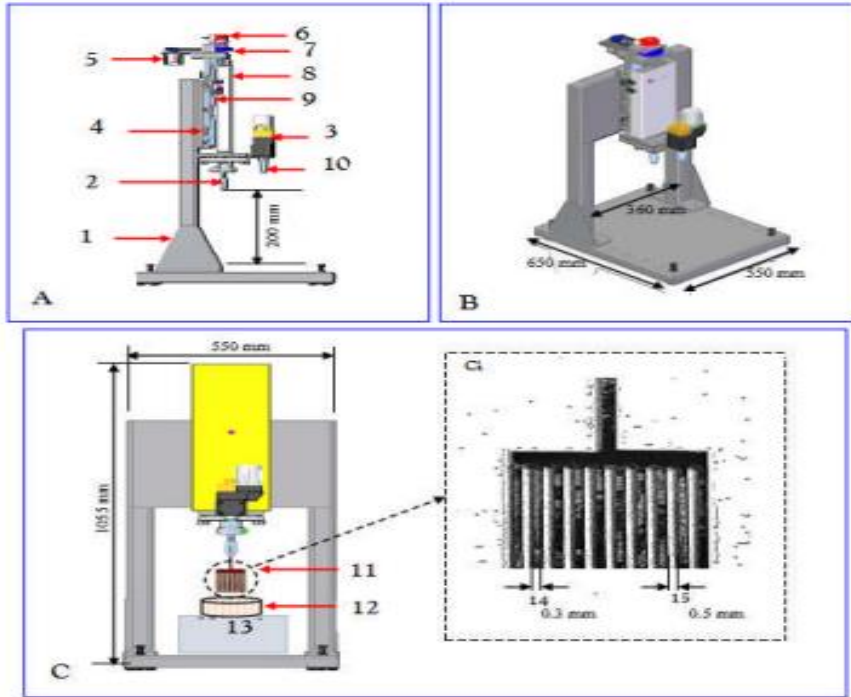
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Images



Figs.1(A,B,C,Ci): Illustrates CAD Drawings and multi pin arrangement, A. Machine structure in detail, B shows isometric view of the machine, C. shows Front view of the machine, D. ; Ci is an inset of C shows enlarged view of the multi-pin tool, 14-pin width and 15-pitch distance

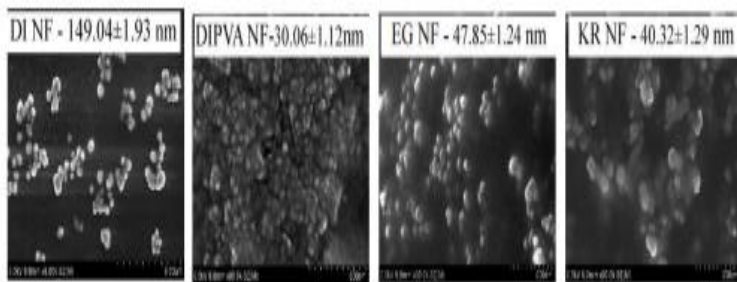


Fig 2: Illustrates FESEM images of silver nanoparticles generated in different fluids

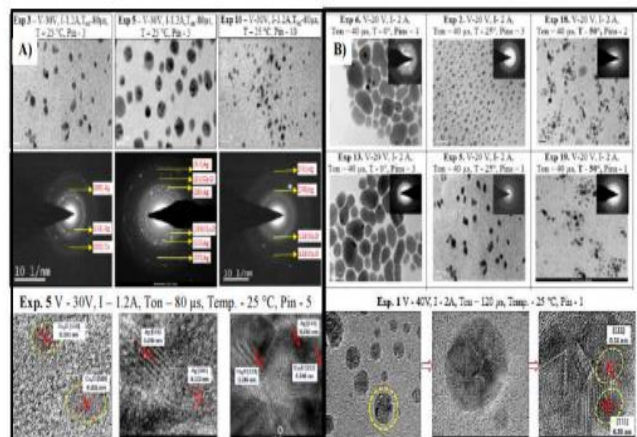


Fig 3: Illustrates HRTEM images of silver-copper & silver-gold nanoparticles

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