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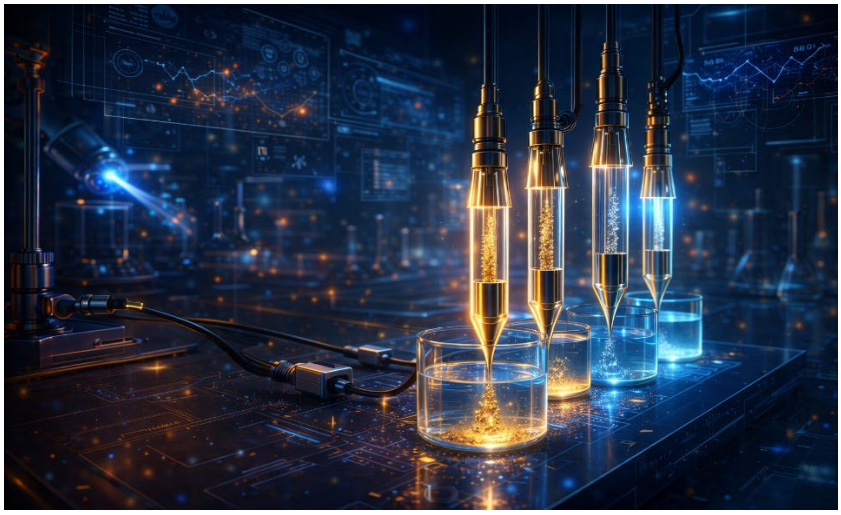
Licensing Opportunity

TTO – Technology Transfer Office

Micro-/Nanoelectrode With Single-Crystalline Metal Deposit



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Keywords

Nanoelectrodes, electrochemical probe, monocrystalline metal chemical growth

Intellectual Property

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Description

This invention introduces a scalable wet-chemical growth method for producing thin-wall metal micro- and nanoelectrodes with long, single-crystalline metal deposits embedded inside glass micro- or nanopipette templates. The approach enables reproducible fabrication of low-RG electrodes with excellent metal/glass sealing and direct electrical contacting. Unlike conventional pulling or electroplating techniques, the method supports batch processing, multiple geometries, and a wide range of metals, while delivering electrodes optimized for high-performance electrochemical probing.

The invention overcomes state of the art drawbacks limiting sensitivity, stability, scalability, and integration into advanced electrochemical and imaging systems (such as defective metal-glass interfaces causing leakage currents, poor reproducibility and serial, low-yield processes or thick insulating glass sheaths), by combining:

- Glass pipette templates with micrometric or nanometric tips
- Wet chemical growth of metal deposits directly inside the tapered pipette
- Controlled nucleation and upward growth to form long, continuous, single-crystalline metal cores
- Physical micro-wire connection for robust electrical contact

The process is compatible with gold, platinum, silver, copper, palladium, bismuth, and alloys, and supports complex configurations such as recessed, dual-barrel, and multifunctional electrodes.

Advantages

- Single-crystalline metal deposits for superior electrochemical performance
- Low RG values (<2) enabling ultra-high spatial resolution
- Long metal cores suitable for direct electrical contacting
- Excellent metal-glass sealing, minimizing background currents
- Batch fabrication for improved scalability and yield
- High versatility in electrode size, geometry, and material choice.

Applications

- Scanning Electrochemical Microscopy (SECM)
- Intracellular and neuronal electrochemistry
- Biosensing and single-molecule detection
- Electrochemical catalysis studies
- Correlative electrochemical–optical techniques (e.g. TERS, fluorescence)
- Multifunctional nanoscale probes for advanced microscopy