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Method for Treating a Surface of a Metallic Structure

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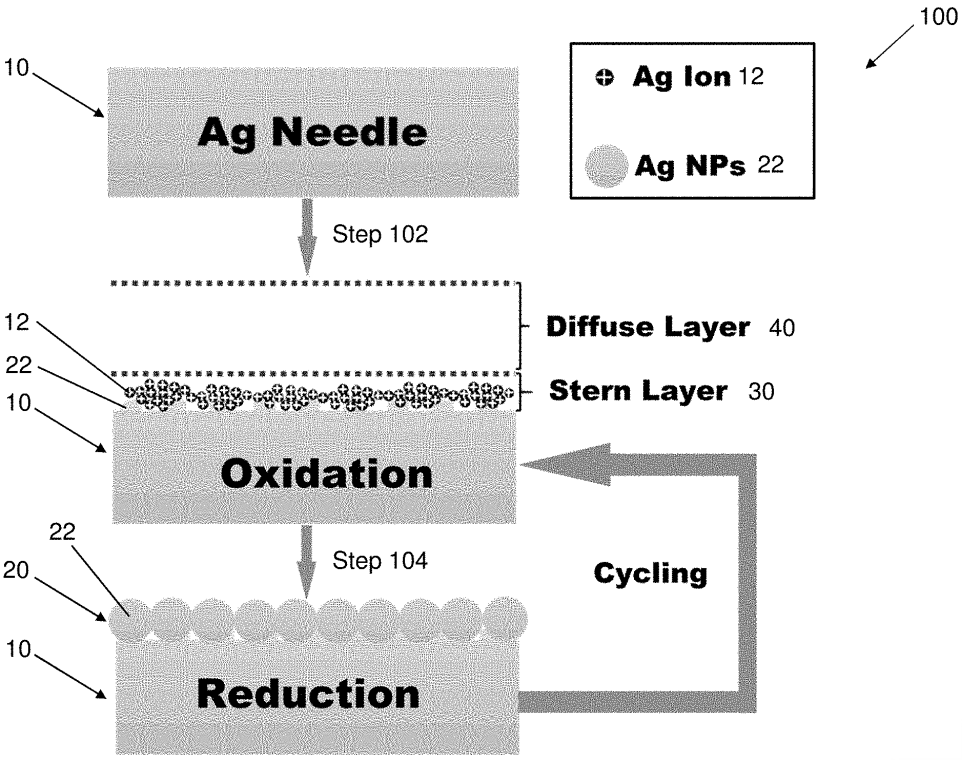

IP Status
Patent granted

Technology Readiness Level (TRL) ? 4

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Opportunity

Noble metals with nanoscaled surface textures have attracted intensive interests for promising potential applications, such as catalysis, sensors, actuators, fuel cells, and surface-enhanced Raman spectroscopy. Copious amount of recipes for tailoring metal surface at nanoscale level have been experimentally developed. However, they ubiquitously suffer from either poor structural uniformity or high cost and tedious procedure, which severely restrict their practical application. As a result, current commercial noble metal products generally display poor surface roughness at the macroscopic sale, leading to unsatisfactory device performances.

Technology

The present invention relates to a method for treating a surface of a metallic structure, the metallic structure being made of a first metallic material, the method including the steps of: (a) releasing metallic ions from the surface of the metallic structure; and (b) depositing a nano-structured metallic layer onto the surface of the metallic structure from the released metallic ions,

wherein the nano-structured metallic layer includes uniform nanoparticles. The treated structure has improved surface roughness, and can be used as electrodes, filters, absorbers, catalysts, and sensors in various applications.

Advantages

- The whole treatment progress is accomplished in a simple aqueous three electrode system at ambient conditions in a one-pot one-step manner. Neither harsh conditions such as vacuum and clean room nor sophisticated and expensive control systems which are generally required by other micro-processing technologies are needed.
- Silver metals acted as silver resources and deposit substrate at the same time. By contrast, for the previous methods, expensive silver salts are needed.
- Remarkable morphological uniformity of Ag nanostructure is conveniently achieved, due to the localization of Ag+ in the stern layer and the suppressed growth of Ag nanoparticles enabled by the pulsed oxidation and reduction.
- Fine control of surface nanotextures and compositions are easily realized by adjusting the electrochemical parameters and additives in the electrolytes.
- A wide range of metal microstructures such as nanoneedles, nanowires, nanosheets, nanocubes, and nanopores, dendrites, and grapes, can be conveniently fabricated.

Applications

- Surface Enhanced Raman Spectroscopy (SERS) substrates
- Industrial Catalyst
- Photovoltaic device
- Supercapacitors
- Sensors
- Electrocatalysis
- Photocatalyst
- Spectroscopy and Plasmoelectronics