TECHNISCHE UNIVERSITÄT WIEN

technology offer

Reference M011/2025

Electrochemical recrystallization of superficial, structure controlled metal nanostructures

nanostructures | electrochemical particle synthesis | heterogeneous catalysts | catalytic surfaces

The technology employs an electrochemical method to deposit metallic nanostructures on the surface of a metallic substrate. The metal nanostructures achieved with this method are structure controlled and determined by the specific crystal structure of the metal species. Moreover, the structures do not require a binding agent or adhesion onto the surface, but are a structural surface feature of the underlying metal substrate.

background

While methods for the synthesis of nanoparticles are well established, the products are mostly achieved in the form of particle powders. Application of these powders onto surfaces often require binding agents, interactive forces with a substrate or prior impregnation of a carrier material with precursor solutions. Powder particles applied this way are prone to gradual particle loss and devices fabricated with these methods might suffer from reduced activity and high electric resistance. Converting metallic surfaces themselves into nanostructures promises mechanically stable and conductive particle assembles as well as components which are easy to functionalize.

benefits

- No hazardous compounds required
- Achievable with uncomplicated setups at mild conditions
- Simple two-step process
- Wide selection of starting materials
- Tunable crystal size
- Independent of the metal surface topology prior to the procedure

potential applications

The technology offers a variety of potential applications using superficial nanostructures, such as catalysis, electrolysis, sensors and fuel-cells.

see also M012/2025

IPR

AT patent application filed

inventors

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technology

The underlying principle of the method is initial anodic dissolution of the desired metal for nanostructures and formation of an insoluble intermediate to immobilize metal cations as well as preset the final particle morphology. Ultimately the intermediate is converted into metallic nanostructures by cathodic reduction.

A sufficiently thick layer of the desired metal is needed and can be applied onto any conductive substrate by methods like PVD or galvanization. For the crystallization of the metallic nanostructures, an electrochemical setup is employed consisting of a working, counter and reference electrode. The metal surface acts as the working electrode, while any inert counter electrode material and reference electrode system can be employed. To achieve the insoluble intermediate, suitable anions are added to the electrolyte.

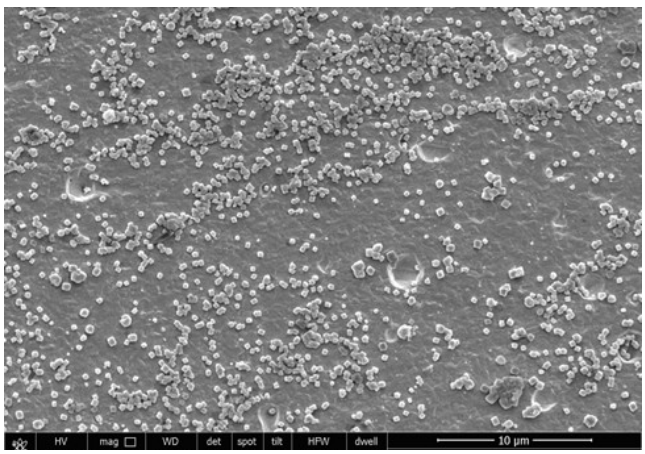

Figure 1: Nickel cubes crystallized on nickel applied by sputtering

development status

TRL 3: Experimental proof of concept

options

R&D-Cooperation, License Agreement, Patent sale

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