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TWO-STEP COST-EFFECTIVE ELECTROCHEMICAL TECHNOLOGY FOR THE PREPARATION OF FREE-STANDING PERFORATED Au NANOMEMBRANES

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Scopul:

It consists in development of an cost-effective electrochemical technology for the preparation of free-standing Au nanomembranes with possibilities to control their porosity.

Soluție:

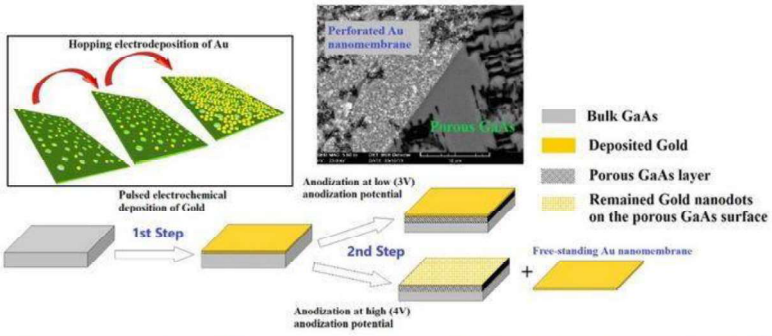
A room-temperature two-step cost-effective electrochemical technology is proposed for the preparation of large area free-standing Au nanomembranes.

Avantaje:

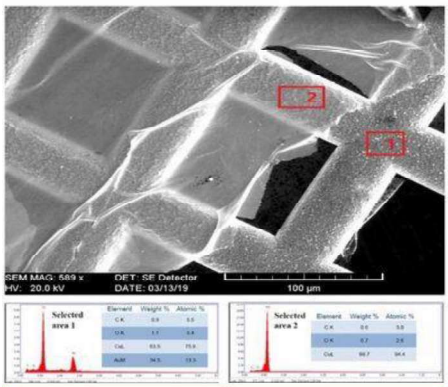
- Simple technological setup;
- The prepared nanomembranes exhibit good flexible properties;
- Posibilities for transfer of the gold nanomembranes to various substrates;
- Different geometrical designs of Au nanomembranes can be obtained via photolithography.

Stadiul:

Free-standing gold nanomembranes;
Large-area nanoperforated gold nanomembranes.



Schematic representation of the technological route for the fabrication of Au nanomembrane on a porous semiconductor substrate with possibilities to be transferred to another substrate. Inset is the illustration of the mechanism of hopping electrodeposition of a monolayer of Au nanodots and SEM image of an Au nanomembrane prepared by electroplating with pulse duration of 300 μs.



EDX analysis of an Au nanomembrane transferred to a TEM grid.

Description of the invention: The proposed method for the preparation of free-standing Au nanomembranes consists of two technological steps. A continuous layer consisting of Au nanoparticles is deposited by pulsed electroplating on a semiconductor (GaAs in our case) wafer in the first step, followed by anodization in a 1M HNO3 electrolyte in the second step to introduce porosity into the GaAs substrate underneath the Au film. Anodization at higher voltage leads to the detachment of the Au film from the porous GaAs substrate with the formation of a free-standing Au nanomembrane. It was shown that detachment of the Au film from the substrate occurs at optimized parameters of anodic etching. The deposited film proved to consist of a monolayer of Au nanoparticles with the mean diameter around 20-30 nm. It was found that nanoholes with the diameter controlled by the duration of cathodic voltage pulses can be introduced into the Au film during electroplating. The flexibility along with possibilities to transfer the prepared nanomembranes to various substrates are expected to be prospective for new optical, plasmonic and electronic applications.

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