

## Fabrication of metallic nanostructures by holographic lithography applied as substrate in Raman spectroscopy

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### Abstract

The proposal of this project is to fabricate periodic metallic structures, using holographic lithography and the liftoff technique, to be used in analytical methods of environmental interest.

*Key words: biosensing, SERS, nanostructures;*

### Introduction

Thin metallic periodic structures exhibit a transmission enhanced at certain wavelengths whose values depend on the relative permittivity of the metal and of the surrounding medium. These peaks are called Extraordinary Transmittance (ET) because they occur for wavelengths greater than the aperture dimensions. The early reports attribute such ET to the excitation of surface plasmons (SP) in the metal dielectric interfaces [1]. The SP modes at the first dielectric metal interface couples with the SP modes at the metal-dielectric interface generating an enhancement in the transmitted light [1]. For an array of slits there are two possible mechanisms to explain such extraordinary transmission peaks [2]: the SPR that occurs only for thin-film metallic arrays of slits and the waveguide resonance (FP), which couples the incident light through the slit. Anyway, for an array of slits or holes, the position of such extraordinary transmission peaks depends strongly on the surrounding media. Thus both types of structures can be potentially used as refractive index sensor of the surrounding media.

With the advance in plasmonics, the employment of analytical methods of high precision such as SERS became more viable and reproducible which is convenient for analysis in samples of environmental interest. With smaller concentration quantification limits is possible to regularize water various standards in a more restrictive way and to supervise in a more rigorous way.

### Results and Discussion

For the fabrication of the metallic structures, high aspect ratio photoresist 2D structures were recorded on glass substrates by interference lithography, followed by the thermal deposition of Au, and further lift-off of the photoresist template using acetone followed by ultrasound (Figure 1). The achieved conditions in the fabrication process of the nanostructures that had optimum results were: Recording of the pattern in the photoresist

with a energy dose of approximately 300mJ/cm<sup>2</sup> for both recordings, since the idea was to produce a 2d array, all samples were produced using two recordings, for the second one, the sample were always rotated 90° in relation to the first one. The exposed photoresist was removed by using AZ351 developer diluted in water in the proportion 1:3.5 for 40 s.

### Conclusions

In this work we fabricate two-dimensional metallic nanostructures using holographic lithography and liftoff technique. Samples were coated with gold and will now be used as substrates in Raman spectroscopy. The results will show the potential of these structures for environmental monitoring.

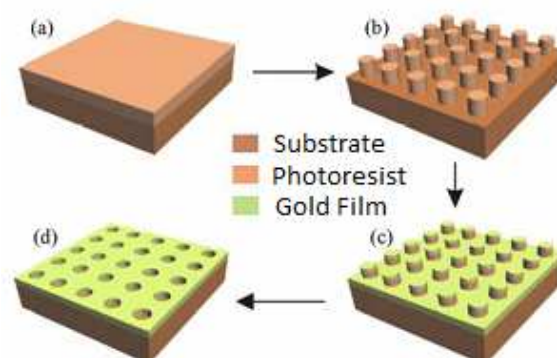


Figure 1 - Steps of fabrication process

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