Optical Properties of Gold Metallic Nanostructures

R. Delgado Macuil[1], V. López Gayou[1], M. Rojas López[1], J. F. Sánchez Ramírez[2] and V. Camacho Pernas[3].

[1]Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada, Acatlan 63 Col. La Paz, C.P.72160, Puebla Pue. México.
[2]Facultad de Ciencias Químicas-ICUAP, BUAP, Blvd. 14 Sur, 6303, Puebla, Pue.72570, México
[3]Universidad Politécnica de Puebla. 25 Pte. 134 Puebla Puebla, México.

ABSTRACT

In this work we analyze the optical properties from nanostructures metallic surfaces of gold-palladium, for this we used light in the visible spectrum. The analysis is based in the width of the films grown and of the ratio of concentration of gold/palladium in films. Transmission spectrum and Z-Scan technique are used to observe the optical properties of these metallic nanostructures.

Keywords: Nanomaterials, colloids, Au/Pd, Co-adsorb; APTMS, ED.

1. INTRODUCTION

Ensembles of nanostructures display unique optical and electrical properties that are distinct from their respective bulk properties and from average measurements of collections of widely spaced particles. To a large extent, however, bulk material properties (i.e., catalytic, optical, and electrical properties and biocompatibility) are determined by nanoscale features. The ability to tune particle, size, shape, chemical composition, array geometry, and linking chemistries provides a flexible platform to manipulate material properties through rational design of the principal components (i.e. metal or semiconductor nanoparticles). Several recent reviews and books detail progress and awaiting challenges associated with nanostructure control [1].

Materials composed from two dimensional (2-D) and three-dimensional (3-D) ensembles of nanostructures are becoming increasingly important in analytical and material chemistries; indeed, practical applications in nanoelectronic and optoelectronic devices, chemical sensors, and catalysis seem imminent. For example, arrays of crystalline-modified polystyrene spheres and suspended ensembles of ligand-coated metal nanoparticles [2] are finding use as vapor-phase molecular recognition sensors. Self-organized 2-D nanoparticle superlattices of latex spheres, CdS, CdSe, Au and Ag structures have been constructed and analyzed.

Systems of 2-D metal nanostructures arrays have unique characteristics: (i) these arrays are easy to synthesize. Concentrated solutions of monodispersed Au nanoparticles from 2 to 100nm in diameter are easily synthesized [3]; Metal nanoparticles readily adsorb onto appropriately derivatized surfaces. Tipically, organosilanes [4,5], Hiperbranched polymers, o alkyltiols are used to generate array with random paching but with a reproducible overall coverage and with a reasonable distribution of interparticle spacing. (ii) Optical properties are a function of particle spacing, size and composition, which are easily tailored attributes; (iii) particles have a high surface area, useful for applications in catalysis, electrochemistry, biomolecule conjugation, and surface-sensitive spectroscopies.

Also metallic nanostructures are very attractive for Raman scattering analysis, because when such structures are added to a sample, the signal could be increased for $\sim 10^6$ factor. There are works that show theoretically [6,7] and numerically [8] that these materials could have interesting optical properties.

5th Iberoamerican Meeting on Optics and 8th Latin American Meeting on Optics, Lasers, and Their Applications, edited by A. Marcano O., J. L.Paz, Proc. of SPIE Vol. 5622 (SPIE, Bellingham, WA, 2004) · 0277-786X/04/$15 · doi: 10.1117/12.589442