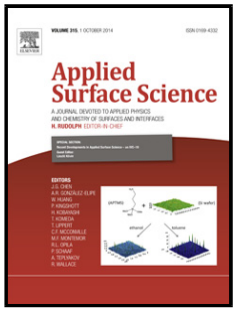


Title: Production Of Silver Nanoparticles By Laser Ablation In Open Air

Author: M. Boutinguiza R. Comesaña F. Lusquiños A. Riveiro J. del Val J. Pou

PII: S0169-4332(14)02195-3
DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2014.09.193
Reference: APSUSC 28849

To appear in: *APSUSC*

Received date: 3-7-2014
Revised date: 2-9-2014
Accepted date: 29-9-2014

Please cite this article as: M. Boutinguiza, R. Comesaña, F. Lusquiños, A. Riveiro, J. del Val, J. Pou, Production Of Silver Nanoparticles By Laser Ablation In Open Air, *Applied Surface Science* (2014), http://dx.doi.org/10.1016/j.apsusc.2014.09.193

# PRODUCTION OF SILVER NANOPARTICLES BY LASER ABLATION IN OPEN AIR

M. Boutinguiza[1], R. Comesaña[2], F. Lusquiños[1], A. Riveiro[1], J. del Val[1], J. Pou[1]

1 Applied Physics Department, University of Vigo EEI, Lagoas-Marcosende, 9. Vigo, 36310, SPAIN

2 *Materials Engineering, Applied Mechanics and Construction Dpt., University of Vigo, EEI, Lagoas-Marcosende, Vigo, 36310, SPAIN*.

## Abstract

Silver nanoparticles have attracted much attention as a subject of investigation due to their well known properties, such as good conductivity, antibacterial and catalytic effects, etc. They are used in many different areas, such as medicine, industrial applications, scientific investigation, etc. There are different techniques for producing Ag nanoparticles, chemical, electrochemical, sonochemical, etc. These methods often lead to impurities together with nanoparticles or colloidal solutions. In this work laser ablation of solids in open air conditions (LASOA) is used to produce silver nanoparticles and collect them on glass substrates. Production and deposition of silver nanoparticles are integrated in the same step to reduce the process. The obtained particles are analysed and the nanoparticles formation mechanism is discussed. The obtained nanoparticles were characterized by means of transmission electron microscopy (TEM), high resolution transmission electron microscopy (HRTEM) and UV/VIS absorption spectroscopy. The obtained nanoparticles consisted of Ag nanoparticles showing rounded shape with diameters ranging from few to 50 nm.

***Keywords:*** silver nanoparticles, laser ablation, pulsed laser, open-air.

## Introduction

Much effort has been made in nanosize materials production due to their unique properties, differing significantly from those in bulk material, which is contributing to develop new nanostructed materials and new applications. Silver nanoparticles have attracted much attention as a subject of investigation due to their well known properties, such as high electrical and thermal conductivity [1], antibacterial and antifungal effects [2-4], high catalytic activity [5], etc. They are used in many different areas, medicine [6-7], photovoltaic energy [8], industrial applications [9], etc. There are different techniques for producing Ag nanoparticles using chemical [10-11], physical [12-13] and biological routes [14-15]. Each method presents its own disadvantages and restrictions, being the chemical one the most used. To prevent the presence of contamination and impurities in obtained products, laser ablation of solids in liquid phase (LASL) has been considered an alternative method to chemical reduction, especially when biological applications are taken into account. Its simplicity together with the advantage of producing nanoparticles with small size, narrow distribution and weak agglomeration make it suitable for metal nanoparticle synthesis. This method lacks of high productivity and for certain applications additional treatments are needed to implement the obtained colloidal solutions. A variety of strategies have been proposed to increase the amount of nanoparticles obtained by LASL, such as the use of a continuously fed wire target to increase the production yield [16]. Besides increasing the nanoparticle productivity, it would be desirable to reduce the processes involved in synthesis and applications of Ag nanoparticles by avoiding the use of additional equipments like vacuum chambers. In previous works we have this method to obtain and characterize metal and non-metal nanoparticles [16-17]. Herein we present a variation of the mentioned method, laser ablation of solids in open air (LASOA) to obtain Ag nanoparticles under ambient