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# Development and characterization of nanocomposites with gold nanoparticles embedded in the nanostructured silicon substrate.

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## ABSTRACT

In the present work an alternative nanoparticle synthesis technique was developed, where the nanoparticles nucleate and grow inside the pores of the nanostructured porous silicon (NPS). Employing green method for the nanoparticle synthesis, yeast extract is used as a reducing agent. The porous layers were prepared by electrochemical etching of Boron-doped (100) Si substrate (0.01-0.02Ohm·cm). The NPS support was immersed into the reactive colloid for different times, then withdrawn, cleaned and dried. SEM and XRD measurements were carried out to characterize the NPS substrate and the immobilized catalyst nanoparticles. EDX mapping shows a homogeneous deposition of nanoparticles on the porous support. The average particle size, calculated from XRD diffractograms (using the Scherrer`s formula), was found between 6 to 10 nm. This method provides a good incorporation and distribution of nanoparticles, also an alternative environment-friendly technique to develop catalytic devices fabricated on silicon substrate with an additional advantage of being integrated with the silicon based microelectronic circuits.

Keywords: Nanostructure, biological synthesis (assembly), Au.

## INTRODUCTION

Highly dispersed gold nanoparticles have been demonstrated to be very active for a number of reactions such as CO oxidation and hydrogenation [1-4]. A prerequisite for their applications in many catalytic reactions is the homogeneous distribution of small gold nanoparticles with diameters between 2 and 5 nm. Several methods (e.g. impregnation, coprecipitation, deposition-precipitation, sol-gel, anion adsorption and chemical vapor deposition) have been developed for the preparation of supported gold catalysts [1-6], but one of their main drawbacks is the difficulty in controlling both the location and size of nanoparticles. Nanostructures of Porous silica (NSP) are an important family of porous materials used as adsorbents and catalyst supports [6]. Their high surface areas, good thermal stability and porous control size are the key advantages. However, it is difficult to load gold onto NSP via deposition-precipitation using $HAuCl_4$ as the precursor, due to the low isoelectric point of NSP, this makes the gold nanoparticles on external surfaces are susceptible to aggregation due to the high surface free energy of small nanoparticles and the lack of space confinements [7-9]. These deficiencies