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NANO / Nanomaterials and nanostructured thin films

Enhanced resonance Raman scattering of spin-coated silver nanoparticles by treatment in a microwave argon plasma jet open to ambient air

L. Stafford[1], J. Trahan[1], J. Profili[1], G. Robert-Bigras[1], M. Mitronika[2], A. Granier[2], M. Richard-Plouet[2]
[1] *Univ. Montréal (CA)*
[2] *Institut des Matériaux Jean Rouxel - Nantes (FR)*

Abstract content

This work investigates the treatment of thin films made of spin-coated silver nanoparticles with dimensions in the 60-80 nm range by an open-to-air microwave argon plasma jet characterized by neutral gas temperatures of 2200 ± 200 K. Scanning Electron Microscopy reveals a consumption of small nanoparticles to produce micrometer-scale aggregates with sharp edges. Similar features with rounder edges are obtained after conventional thermal annealing. In both conditions, Auger Electron Spectroscopy and X-ray Diffraction analysis indicate an oxidation of silver nanoparticles. However, only plasma-exposed samples exhibit a rise in the surface-enhanced resonance Raman scattering (SERS) signal. By combining 58 58 µm2 mappings of Hyperspectral Raman IMAging (RIMA) with multivariate curve resolution by log-likelihood maximization, it is shown that SERS enhancement is controlled by aggregated domains.