Embedded silver nanoparticle multilayers fabricated by femtosecond pulsed laser deposition

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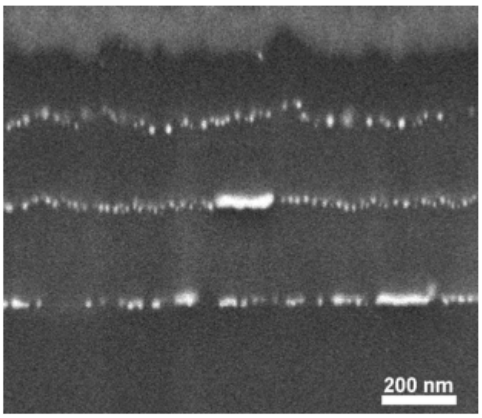
Abstract
Deposits of exposed and embedded silver nanoparticles were grown on Si(100) and silica substrates by laser ablating high-purity silver and SiO_2 targets in vacuum using a femtosecond Ti:sapphire laser delivering 45 fs pulses at 804 nm and 1 kHz repetition rate. The effect of the laser fluence and irradiation time on the obtained nanostructures was investigated using several fluences between 650 mJ/cm^2 and 3.2 J/cm^2 and deposition times in the range of 1-20 minutes. Optical response of the deposits was characterized using optical absorption spectroscopy and the surface morphology was studied by scanning electron microscopy (SEM). Samples with the optimal optical response were obtained by depositing three successive Ag/SiO_2 bilayers at the main laser wavelength (804 nm) under vacuum at substrate room temperature. They were composed of silver nanoparticles with an average diameter of 6 nm and a narrow size distribution; each layer of these nanoparticles was then separated by silica layers of approximately 100 nm. The laser fluence and deposition time for Ag (SiO_2) were 650 mJ/cm^2 (3.2 J/cm^2) and 1 min (10 min), respectively.

Figures



SEM micrograph of the transversal section of a multilayer structure (Ag/SiO_2/Ag/SiO_2/Ag/SiO_2) deposited on a silica substrate.