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Structural and Optical Properties of Silver Nanoparticles In Situ Synthesized in ZnO Film by Sol–Gel Method

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Abstract. We fabricate the samples with two layers of silver nanoparticles embedded in ZnO film exploring sol–gel method by varying the annealing temperatures. The structural properties of the samples are determined by transmission electron microscopy. The effect of the annealing temperature on the nanoparticles plasmon absorption spectra is studied. Annealing at 570 °C results in a shift of the plasmon absorption maximum from 580 nm to 620 nm, due to an increase in the nanoparticles average size from 63 nm to 74 nm. Increasing the annealing temperature to 650 °C results in a shift of plasmon absorption maximum back to 580 nm due to a decrease in the nanoparticles size to 61 nm. Before annealing, the silver nanoparticles of the upper layer locate on top of the nanoparticles of the bottom layer, however, in the plane of the layers, they are arranged randomly at a distance of 30 to 150 nm from each other. As a result of the annealing, the system tended to be ordered, as a result, the nanoparticles in the layers become to be distributed equidistant at 40–70 nm between them; the nanoparticles of the upper layer tend being located between the nanoparticles of the bottom layer.

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