

Thermal behavior of silver nanoparticles in aluminosilicate glasses

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Abstract – Metal colloids or nanoclusters, embedded in glasses, have been found to introduce desired third-order optical nonlinearities in the composites at wavelengths very close to that of the characteristic surface-plasmon resonance of the metal clusters. Small spherical silver particles in a soda-lime silicate (SLS) glass were produced by means of the ion exchange method. Emphasis is given to the comparison among existing approaches to the understanding of the chemical interaction in these system.

Soda lime silicate (SLS) glasses containing 0.020-0.015 wt % (AgNO_3), Nano 1 and Nano 2, respectively, were prepared in this experiment. A mixed batch was melted under an ambient atmosphere in alumina crucible at 1500°C - 1400°C (depending of the composition) for 4 h.

Glass samples were obtained by quenching the melt to room temperature. The resultant transparent glass was cut, polished on both sides, and subjected to experiments. The Figure 1 (a) and (b) shows the absorption spectra of the heat treated samples Nano 1 and Nano 2, respectively. Both of them exhibited distinctive absorption band, indicating the formation of silver nanoparticles. These distinctive absorption bands are due to the *surface plasmon* (SP) resonance [1,2]. It is known that the SP frequency depends on the dielectric conditions prevailing in the host matrix and the nanoparticles as well as their shape, size and distribution.

The experimentally observed changes in the OA spectra as the temperature increases can be explained by the competition between the rate of silver ion diffusion across the matrix and the neutral silver nucleation rate. An increase in the peak intensity and slight shift in the peak position were observed as the time of treatment increases, this occur in 500°C for Nano 1 and 400°C for Nano 2.

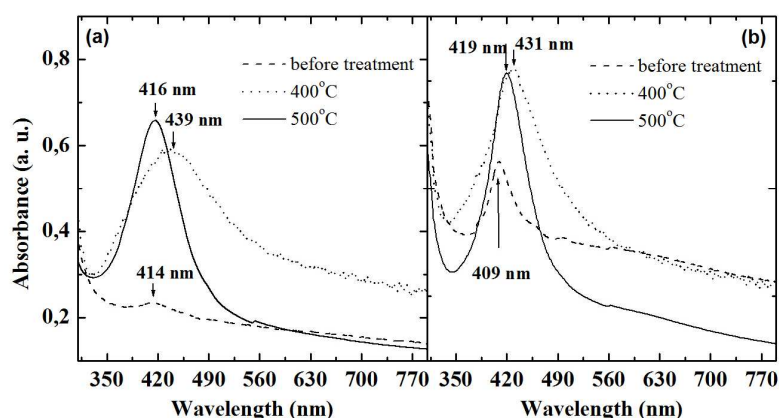


Figure 1: Absorption spectra of SLS glasses doped with silver nanoparticles. (a) Nano 1. (b) Nano 2.

References

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