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Abstract

Metallic sodium nanoparticles with the sizes 4 –6 nm are synthesized for the first time in bulk of fluorine phosphate glass by the high-temperature synthesis under reducing conditions with the subsequent additional heating. The obtained nanoparticles manifest themselves by the absorption band in the region 400-450 nm determined by the surface plasmon resonance. The effect of additional compression of the melt in the course of cooling as well as the subsequent heating conditions on the characteristics of plasmon resonance band intrinsic to sodium nanoparticles was studied. The glasses subjected to high compression in the course of cooling in combination with the subsequent heating near Tg are featured with two peaks in the surface plasmon resonance band indicating the symmetry distortion in the nanoparticles due to the transition from spherical to ellipsoidal shape. The increase of additional heating temperature is found to provide spherical nanoparticles.

The increase of additional heating time resulted in (i) the "red" (longer wave) shift of the surface plasmon resonance band, (ii) a certain decrease in the band intensity, and (iii) broadening of the band probably determined by the chemical damping due to the formation of new surface states at the nanoparticle/matrix interface.

Key words: metal nanoparticles, surface plasmon resonance, glass, sodium