SIZE AND TEMPERATURE DEPENDENCE OF THE SURFACE PLASMON RESONANCE IN SILVER NANOPARTICLES

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S u m m a r y

The size and temperature dependences of the surface plasmon energy are studied for silver nanoparticles embedded in a silica host matrix in the size range 11–30 nm and in the temperature interval 293–650 K. It is revealed that the surface plasmon energy in studied silver nanoparticles depends on the size and the temperature of nanoparticles. As the size of nanoparticles decreases or the temperature increases, the surface plasmon resonance shifts to the red side. When the size of nanoparticles decreases, the rate of scattering of the conduction electrons on the nanoparticle surface increases, which results in a nonlinear red shift of the surface plasmon resonance. The temperature dependence of the red shift is linear for larger nanoparticles and becomes nonlinear for smaller ones. It is shown that the volume thermal expansion of nanoparticles leads to a red shift of the surface plasmon resonance, as the temperature increases. It is revealed that the thermal volume expansion coefficient depends on the size and the temperature. It increases with decrease of the nanoparticle size and with increase of the temperature.