RESEARCH OF PLASMONIC PROPERTIES OF THE COPPER SULFIDE NANOSTRUCTURES

Vernyhor Oleksandr, Sosenko Stanislav, Bulavinets Tetiana, Yaremchuk Iryna, Fitio Volodymyr, Bobitski Yaroslav

Department of Photonics, Lviv Polytechnic National University, S. Bandery str. 12, Lviv, 71013, Ukraine.
E-mail: iryna.y.yaremchuk@lpnu.ua

Abstract

The spectral characteristics of the copper sulfide nanostructures under the conditions of localized plasmon resonance have been studied. The influence of nanostructures deformation, namely prolate and oblate nanoparticles, on their optical characteristics has been researched. The size-dependence of the localized surface plasmon resonance peak intensity and peak position have been studied. The strong dependence of the localized surface plasmon resonance effect on the dielectric permittivity of the surrounding medium was checked.

Results and discussions

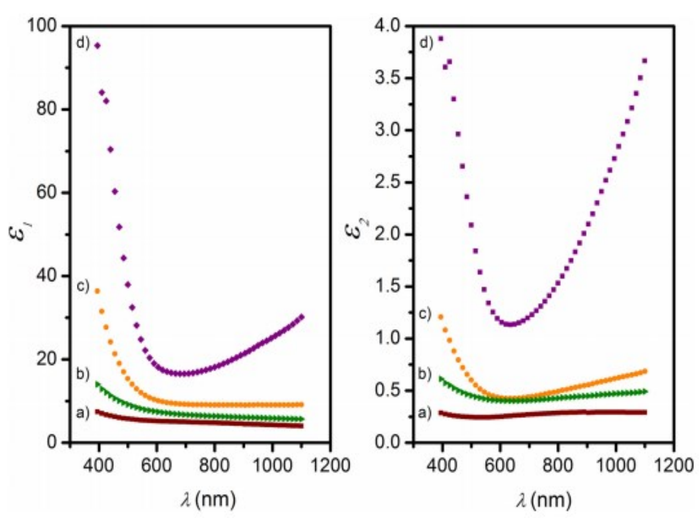

Fig. 1 Dependences of the real (a) and imaginary (b) parts of the dielectric constant of CuS films on the wavelength [Erken, O., at al. Optik, (2018)]

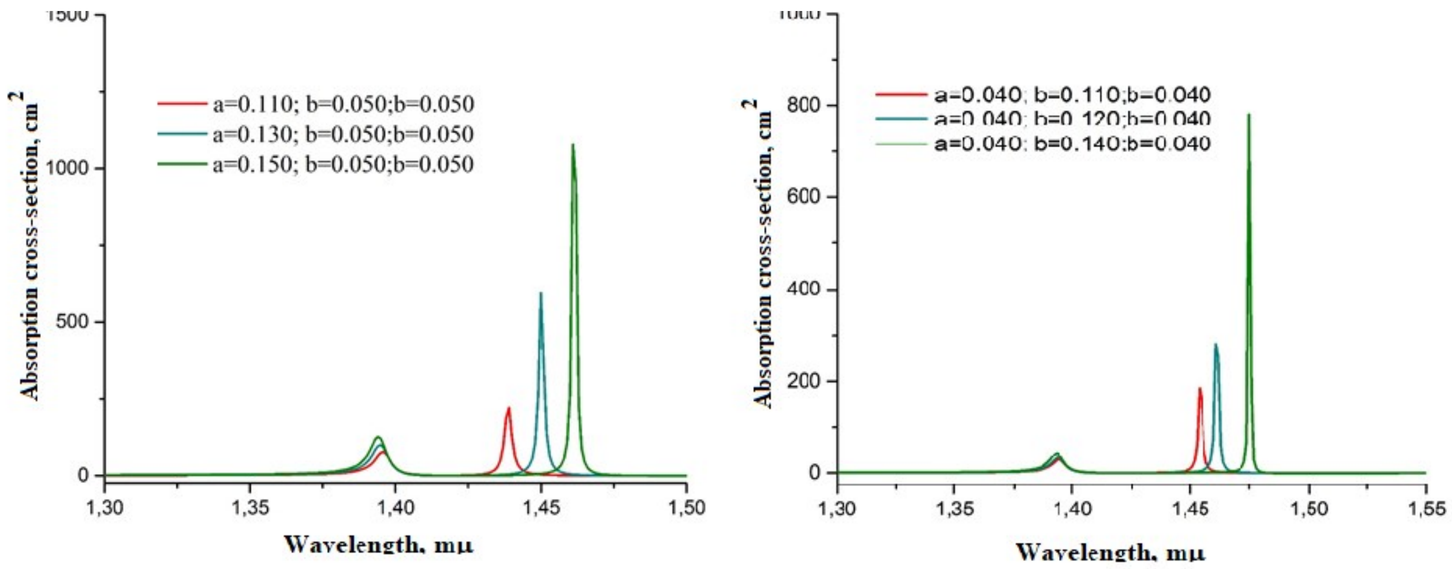

Fig. 2. Absorption cross-section dependence on the wavelength of the nonspherical CuS nanoparticles arranged in the air at the different values of the semiaxes a and b

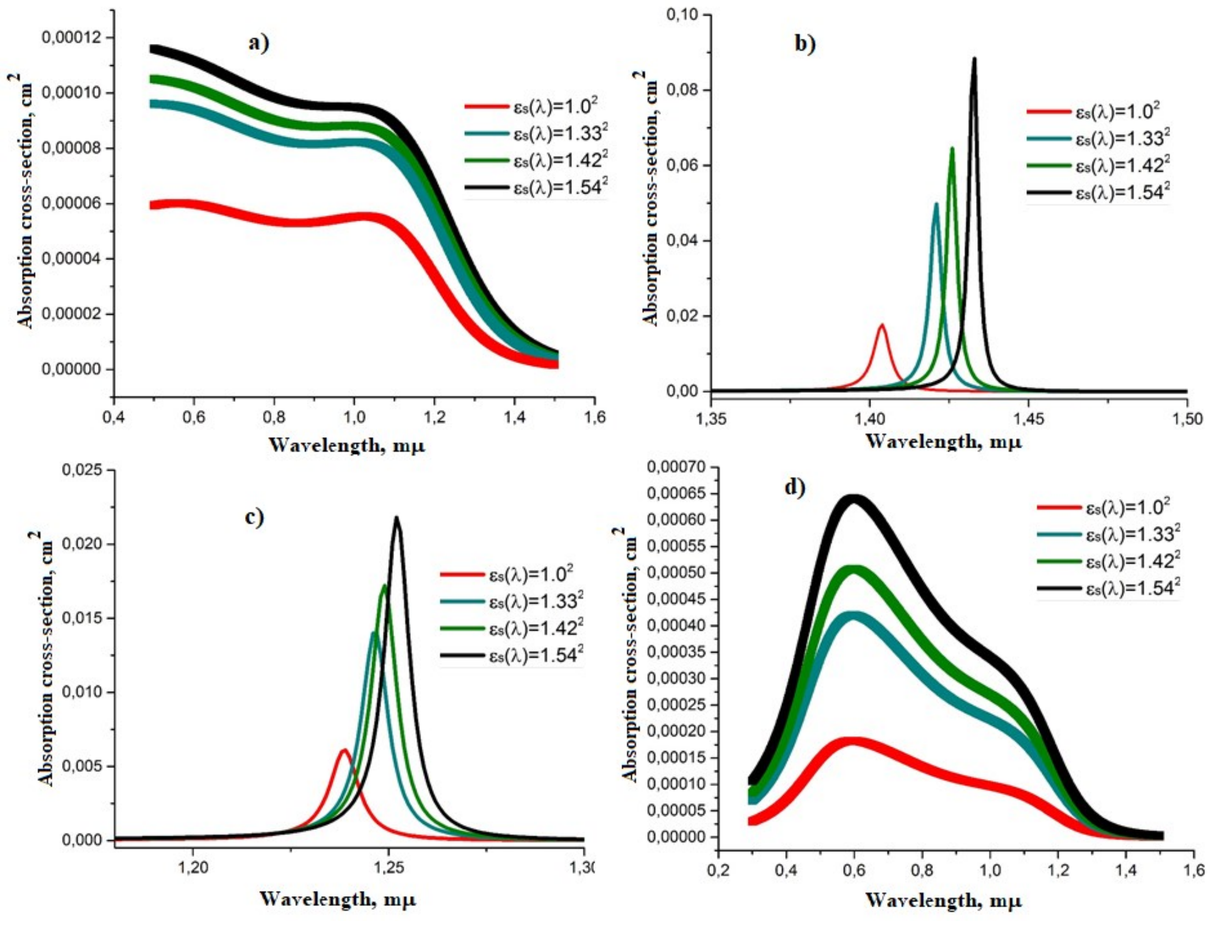

Fig. 3. Absorption cross section dependence on the wavelength of spherical CuS nanoparticles with the radius of 30 nm at various values of the surrounding media refractive index

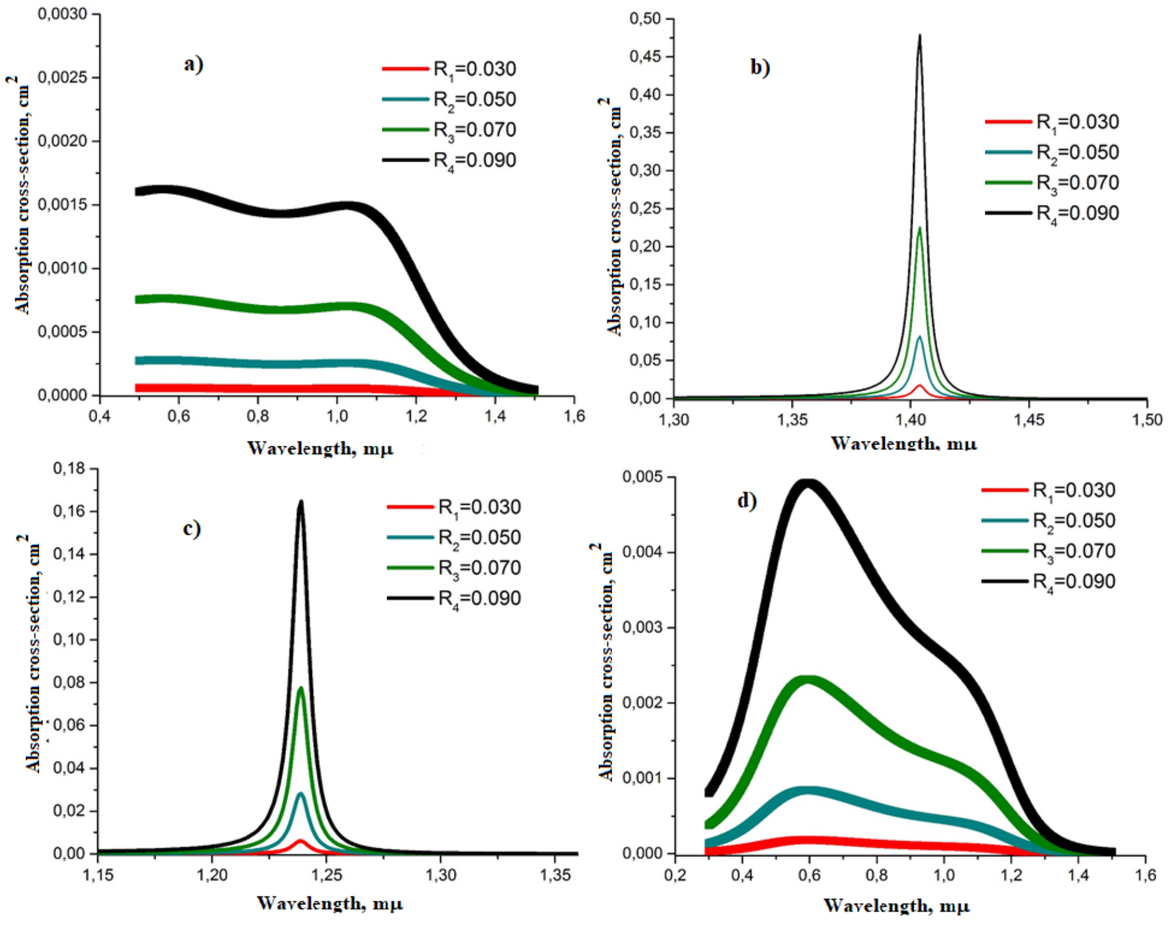

Fig. 4 Absorption cross section dependence on the wavelength of spherical CuS nanoparticles arranged in the air at the different values of the nanoparticles radius

Conclusions

It was shown that the surrounding medium refractive index affects the amplitude of the absorption cross section dependence on the wavelength. In addition, it affects the position of the plasmon absorption peak. The procedure of the nanostructured copper sulfide preparation has a decisive importance for its resulting characteristics. The nanoparticles size affects the absorption cross section maximum and leads to the change in the half-width of the spectrum. However, it practically does not affect the position of the peak of the plasmon resonance. The nonspherical nanoparticles are characterized by two peaks of plasmon resonance. The value of the first peak maximum remains unchanged and the value of the second peak increases when nanoparticle size increases. The distance between the peaks will be depend on the ratio between the axes of the nonspherical nanoparticle.

Acknowledgements

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