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SERS-enhancement of chalcogenide films

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The effect of plasmonic nanoparticles (NPs) on Raman spectra and underlying structural changes in thin chalcogenide films are investigated. As2S3 and Se films with a thickness of several tens of nanometers were deposited by thermal sputtering for comparison on ordinary glass and SERS substrates based on arrays of gold nanostructures. Films on glass are practically not detectable by Raman spectroscopy, while using arrays of gold NPs as substrates allows for reliable registration of Raman spectra of both As2S3 and Se films, with all the features present, which are usually manifested in films with a thickness of 1 μm or more. Based on our analysis of spectra obtained using different excitation wavelengths, we can conclude that the main contribution to the enhancement of the Raman signal from chalcogenide films is provided by a chemical mechanism of SERS. Adjustment of the parameters of SERS substrates to tune their plasmon band position in resonance with exciting laser radiation enables the contribution of plasmonic enhancement to be increased.
It is concluded that the main contribution to the enhancement of the Raman signal from chalcogenide films is provided by a chemical mechanism, presumably due to the involvement of the Fermi level of the gold NPs in the resonant Raman scattering in the chalcogenide. Additional adjustment of the parameters of SERS substrates to tune their plasmon in resonance with exciting laser radiation allows one to increase the enhancement factor. It is shown that As2S3 and Se chalcogenide films are quite sensitive to photo- and thermal excitation leading to rearrangement of the local structure, which can correspondingly affect their other properties.
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Topics

Session D. Biomedical optics and sensors technology

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