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Raman Spectra in As-Based Chalcogenide Optical Fibers

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Abstract

Raman spectra for optical fiber samples prepared from As-based chalcogenide glass composition (As50S50, As40S60, As25S75, (As40S60)0.95:(As40Se60)0.05 and (As40S60)0.95:(Sb40S60)0.05 are investigated. The primary maximum in the Raman spectra situated around the frequency ν = 343 cm−1 is characteristic for all glass compositions and is attributed to the symmetric stretching vibrational mode of AsS3/2 pyramids. For the sulfur-rich composition the splitting of this maximum is more pronounced. For the compositions of sulfur in excess the Raman spectra are characterized by the weak bands at ν = 473 and ν = 497 cm−1 which are associated with the S—S stretching vibration in S8 rings. The presence of weak bands in bulk glass, thin films and optical fibers situated at ν = 188 and ν = 234 cm−1 can be attributed to the bending modes of non-stoichiometric structural units of As4S4 and S2 in the glass network. For the optical fibers made of As40S60 the broad maximum around ν = 152 cm−1 is observed, which is absent in the case of bulk glasses. For the optical fibers based on As2S3–Sb2S3 the intensity of Raman signal increases in respect to optical fibers of pure As2S3 glass. The Raman spectra are examined in terms of the molecular model of the glass structure.