Surface excitations in nanocomposites based on porous III-V semiconductors

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Abstract. In this work, we investigated porous layers obtained by electrochemical etching of n-type GaAs, InP, and GaP single crystals [1,2]. Electrochemical etching techniques provide wide possibilities for formation layers with different morphology, in particular quasi-ordered array of pore with possibility to control pore shape and size. Far-infrared spectral region is very attractive for the characterization of porous polar semiconductors because, unlike well-studied por-Si for polar semiconductor compounds, the specific region of the Reststrahlen band and also mixed plasmon-phonon mode in doped materials exist. For our samples, we investigated specular reflection that is traditionally enough and attenuated total reflection (ATR) in Otto geometry, with consideration of phonon and plasmon-phonon surface polariton excitation.

The ATR spectra are changed more significantly due to the porosity, and also their fitting curves are more sensitive to the changes in fitting parameters. The results of the fitting made in the isotropic Bruggeman model show that frequencies of longitudinal and transverse optical phonons don't change. Also, they prove the depletion of porous layers by free carriers. Reasonable and correlating porosity values were obtained. Most interesting is that the phonon damping values were changed not so much and we can say that the skeleton

is a good monocrystal. Surface polariton (SP) spectroscopy shows much promise for porous composite medium characterization since SPs are very sensitive to the essential parameters of porous semiconductor layers such as porosity, symmetry, free carrier concentration, thickness, etc. The usage of these porous layers as a skeleton to create composites with organic and inorganic components seems perspective [3].

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