APPLICATION OF SURFACE WAVES FOR STUDYING THE CHARACTERISTICS OF GAS-TRAPPING SENSORS LOCATED ON A SOLID SURFACE

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Current trends in engineering allow one to build up the atomic (nanoscale) architecture of the surface of solid supports in a controlled manner. The microfabricated surfaces of acoustic-wave sensors can be made highly responsive to the mass adsorbed from a gas, vapor, or liquid phase. In this context, the theoretical analysis and the modeling of the dynamics of a propagation of acoustic waves in the adsorbed monolayer on the surface of an oscillating crystal is an important part of the research of sensors. In the present work, we consider the surface vibrations of pure shear waves in the case of the (001) surface orientation in face-centered cubic crystals with adsorbed surface monolayer. We consider a case of impurity atoms of both lighter and heavier lattice atoms. The impurity monolayer atoms lighter than the matrix atoms result in the frequency of the surface wave to split off from the upper bound of the continuous spectrum, and the amplitude of such a wave decreases and oscillates as the PC is removed from the surface into the depth of the crystal (Fig. 1). In case of heavier atoms, the frequency of the surface waves is split off from the lower bound of the solid spectrum, as in the absence of the adsorbed monolayer, and the amplitude of oscillations decreases monotonically as the wave moves away from the surface.

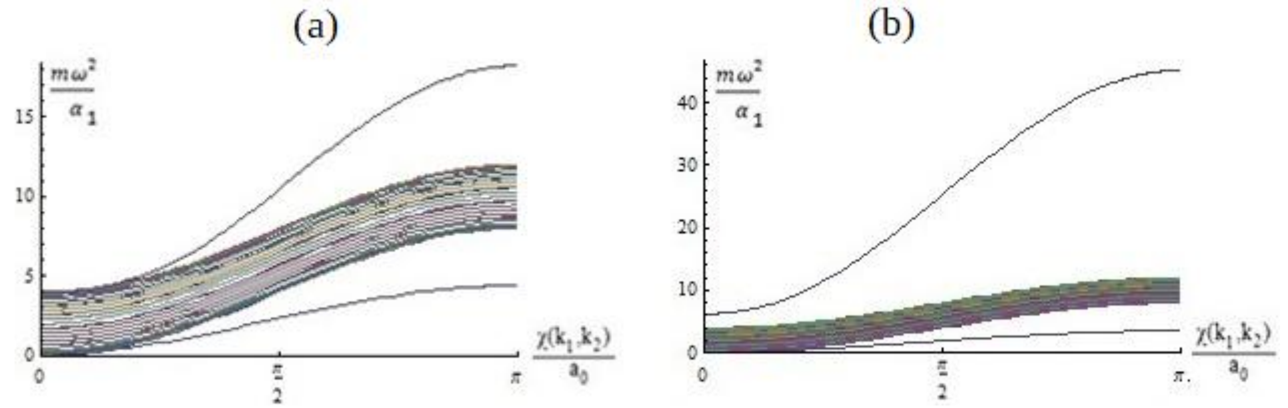

Fig. 1. Volume vibration band and surface waves in a face-centred cubic crystal with adsorbed surface monolayer: (a) $\mu = 2$ and $\mu = 1/2$, (b)$\mu = 5$ and $\mu = 1/5$; here $\mu = m/m_0$ where m_0 is the mass of a matrix atom (lattice atom) and $m$is the mass of an adsorbed atom of the monolayer.