

OUT-OF-PHASE Bi NANOWIRES ON Si(001) SURFACE

*S.Yu. Bulavenko, I.P. Koval, S.P. Kulyk,
P.V. Melnik, N.G. Nakhodkin*

Kyiv Taras Shevchenko National University,
Faculty of Radiophysics
(2, Academician Glushkov Prosp., Kyiv 03127, Ukraine)

S u m m a r y

The structure of Bi nanowires on Si(001) 2×1 surface was investigated by scanning tunneling microscopy (STM). In addition to in-phase nanowires, which are known from the literature, out-of-phase ones were revealed for the first time, and models of their structure have been proposed. It is shown that a relaxation of the stress originating from a difference in bond lengths between Si atoms in a substrate and Bi atoms in a nanowire gives rise to a rearrangement of defects into aggregations of the type of vacancy trenches arranged in parallel to the nanowire on the Si(001) 2×1 substrate. At temperatures 20 – 40 °C higher than the nanowires formation temperature (520 °C), a degradation of nanowires begins due to the appearance of defects which are the substitutions of Si dimers for Bi atoms. The activation energy of the desorption of Bi from out-of-phase nanowires is 0.05 eV higher than that from in-phase nanowires, that is the evidence of higher stability of the out-of-phase Bi nanowires on the Si(001) 2×1 surface.