New structural phase of single atom thick layer of antimony

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Recent years brought significant increase of interest in two dimensional materials built of elements from XVth group of the periodic table. Phosphorene, bizmuthene and antimonene are of particular interest because of expected high mobility of charge carriers and direct band gap which in addition can be easily tuned. Contrary to its neighbours in that group antimonene has many additional advantages e.g. it is resistant to oxidation and does not degrade in contact with water. Theoretical studies predict numerous phases of antimonene [1], however, only two of them have been synthesized [2,3]. The α phase has a puckered structure with two atomic sublayers [2] and β phase has a buckled honeycomb structure [3].

This paper presents results of experimental STM, LEED, LEEM and theoretical DFT studies indicating the formation of a new structural phase of single layer of antimony atoms. The layer has been prepared on a W(110) substrate by molecular beam epitaxy. The new phase of single atom thick antimony film has completely different crystallographic structure compared to the known structures including theoretically predicted ones. It is in part defined by a symmetry and structural order of the underlying tungsten substrate. It appears that the antimony atoms form homogenous film with lateral size of the order of several mm. According to the STM measurements and DFT calculations the layer is perfectly flat and possesses neither buckling nor atomic sublayers characteristic for the known phases of antimonene.

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