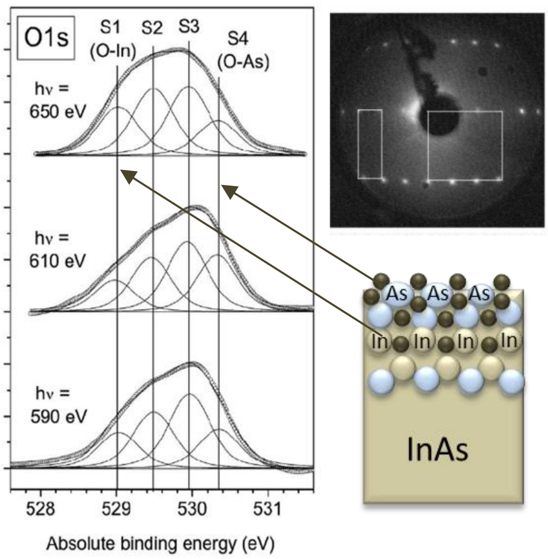
# OXIDIZED CRYSTALLINE (3×1)-O SURFACE PHASES OF InAs AND InSb STUDIED BY HIGH-RESOLUTION PHOTOELECTRON SPECTROSCOPY

M. Tuominen,[1] J. Lång,[1] J. Dahl,[1] M. Kuzmin,[1,2] M. Yasir,[1] J. Mäkelä,[1] J. R. Osiecki,[3] K. Schulte,[3] M. P. J. Punkkinen,[1] P. Laukkanen,[1] and K. Kokko[1]

[1] Department of Physics and Astronomy, University of Turku, FI-20014 Turku, Finland
[2] Ioffe Physical-Technical Institute, Russian Academy of Sciences, St. Petersburg 194021, Russian Federation
[3] The MAX IV Laboratory, Lund University, P.O. Box 118, SE-221 Lund, Sweden
email: tmleir@utu.fi

Atomic scale knowledge of the properties of oxidized III-V semiconductor layers is important not only in understanding the fundamental process of semiconductor oxidation but also in engineering materials for III-V nano-electronics, since oxidized surfaces and interfaces form such an essential part of the device materials. Devices utilizing III-V semiconductors include, for example, metal-oxide-semiconductor field-effect transistors (MOSFETs), high-efficiency multi-junction solar cells, infrared detectors, lasers and LEDs. However, as the oxidized semiconductor layers are usually amorphous and buried, it is challenging to investigate and control their properties with atomic resolution. Related to this problem, recently discovered crystalline oxidized III-V surfaces [1] provide well-defined templates to study III-V oxidation in general. Especially the (3×1)-O surface phase that belongs to the family of these novel crystalline oxides has turned out to be of great interest, since it enhances the performance of nano-electronics devices in practice. The pre-oxidized crystalline (3×1)-O structure on InAs(100) has been found to significantly improve insulator/InAs junctions for III-V MOSFETs [2, 3].

The formation mechanism and the atomic structure of the beneficial (3×1) oxide layer are still unclear. For this purpose, we present different atomic sites and bonding environments for the (3×1)-O structure on InAs(100) and InSb(100) based on synchrotron radiation photoelectron spectroscopy experiments [4]. Furthermore, findings suggest a two-fold oxidation process: (i) oxygen atoms diffusing to the crystal substitute group V atoms and (ii) the relieved group V atoms become oxidized on the surface. This analysis provides not only valuable information for developing insulator/III-V junctions further, but also a stringent test for the theoretical atomic model of the (3×1)-O structure.

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