

# Crystal surface characterization

Konstantin Nikolaev<sup>1</sup>, Igor Makhotkin<sup>1</sup>, Sergey Yakunin<sup>2</sup>, Robbert van de Kruijs<sup>1</sup>, Fred Bijkerk<sup>1</sup>

<sup>1</sup> *MESA+ Institute for Nanotechnology, University of Twente, Netherlands*

<sup>2</sup> *NRC Kurchatov Institute, Moscow, Russia*

Characterization of the structure of the crystal surface is essential for next generation electronics devices. Such as spin injection structures and topological insulators, to name a few. We have studied the advantages of characterization of the crystal surface based on the analysis of modulations of specular X-ray reflection occurred during the azimuthal scan in grazing incidence X-ray diffraction (GID) geometry. In GID geometry incidence angle is fixed, therefore specularly reflected beam typically does not change during the azimuthal rotation of the sample. Unless, sample is aligned to a Bragg diffraction conditions where a modulation of specularly reflected beam intensity occurs. This modulation is known to be sensitive to thickness of the surface (amorphous layer or distorted crystal layer) on an angstrom level [Bushuev, V. A. et al. *Journal of Physics D: Applied Physics*, 35(12), 1422]. Mathematical simulation showed that the thickness of the surface layer affects modulation of specular reflectivity in GID even without optical contrast between the surface and the bulk of material. In addition, simulation showed that in that technique density and thickness of the surface layer are not correlated. We expect that simple geometry and high brightness of the specularly reflected beam will allow to implement that technique on the lab diffractometer, on the contrary to the crystal truncation rod, that only can be implemented at synchrotron.