## Cleaved cubic perovskites: Tuning the surface morphology by ferroelectricity and doping

D. Wrana,<sup>1</sup> I. Sokolovic,<sup>2</sup> L. Albons,<sup>1</sup> A. Alexander,<sup>1</sup> U. Diebold,<sup>2</sup> <u>M. Setvin<sup>1</sup></u>

<sup>1</sup> Charles University, Department of Surface and Plasma Science, V Holesovickach 2, 180 00 Prague, Czech Republic

<sup>2</sup>TU Wien, Institute of Applied Physics, Wiedner Hauptstrasse 8-10/134, 1040 Vienna, Austria

Martin.setvin@mff.cuni.cz

Perovskites are technologically important materials with a general formula ABO<sub>3</sub>. The ternary character of these compounds and the mixture of ionic and covalent bonds brings numerous challenges for surface science: These surfaces can optimize their energy by several mechanisms [1] and they can adopt a myriad of different terminations and reconstructions. Here we focus on the possibility of achieving truly bulk-terminated surfaces of three prototypical perovskites: SrTiO<sub>3</sub>, KTaO<sub>3</sub> and BaTiO<sub>3</sub>. Cleaving along the (001) plane can provide surfaces with well-defined atomic structure and a mixture of two terminations (AO and BO<sub>2</sub>). We show that the layout of these terminations is dictated by electrostatics and is linked to ferroelectric polarization and concentration of charge carriers. We illustrate how the surface morphology can be engineered by ferroelectric polarization prior to the cleaving, using an example of BaTiO<sub>3</sub>. The role of n-type doping will be illustrated on the example of Nb-doped SrTiO<sub>3</sub>.



Fig. 1. Topography of a cleaved KTaO<sub>3</sub> (001) surface. Noncontact AFM image, 400x400 nm<sup>2</sup>.

[1] M. Setvin, M. Reticcioli, F. Poelzleitner, J. Hulva, M. Schmid, L. Boatner, C. Franchini, U. Diebold, Science, 359, 572 (2018)