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Direct characterization of the surface layer of BiFeO3 Single Crystals NEUS DOMINGO, JACKELINE NARVAEZ, Centre d'Investigació en Nanociencia i Nanotecnologia CIN2, CSIC-ICN, Campus Bellaterra, 08193 Barcelona, Spain, XAVI MARTÍ, Charles University in Prague, Faculty of Mathematics and Physics, Czech Republic, MARIN ALEXE, Max Planck Institute of Microstructure Physics, Weinberg 2, 06120 Halle, German, GUSTAU CATALAN, Centre d'Investigació en Nanociencia i Nanotecnologia CIN2, CSIC-ICN, Campus Bellaterra, 08193 Barcelona, Spain — A surface layer different from the bulk was found in single crystals of BiFeO3, and was analyzed with different techniques such as surface impedance and grazing incidence x-ray diffraction, showing an specific phase transition at T* $\sim$ 275 °C. Local physical characterization studies have been performed with different AFM techniques, such as Piezoelectric Force Microscopy (PFM), Scanning Kelvin Probe Microscopy (SKPM) and Force Modulated Microscopy (FMM) at different temperatures up to 300°C. The thin superficial skin layer is found to be an electrically "dead" layer with a thickness of 6 +/- 1 nm and different thermal expansion coefficient with respect to the bulk. The sharp thermal expansion of the surface layer at T* facilitates its mechanical declamping from the underlying crystal at the transition temperature, enabling direct access to the sub-surface region using scanning probe microsocopy techniques. A distribution of near-surface ferroelectric domains is found in a region of less than 200 nanometers deph under the surface. These nanodomains organize in a hierarchical metastructure on top of the existing bulk domains. The symmetry and properties of these sub-surface nanodomains will be discussed.

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