**Nanoscale Domain Dynamics Characterization Using Local C-V Mapping**

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Nanoscale characterization of polarization switching behavior is important in the future development of piezoelectric and ferroelectric devices. Recently, we have developed a novel probe microscopy technique for local C-V mapping based on scanning nonlinear dielectric microscopy (SNDM). This method enables detailed analysis of dynamic polarization switching behavior beyond the conventional static domain observation.

An SNDM system has an LC oscillator probe, which enables local capacitance deviation to be detected with high sensitivity. In a conventional SNDM observation, an AC bias voltage below a domain switching voltage is applied to a sample, and a nonlinear response is detected to visualize the static domain structure. On the other hand, in the novel method, the response is measured with a large-amplitude AC bias above the polarization switching voltage. For ferroelectric films, C-V curves observed in this way draw a butterfly curve, as with macroscopic measurements. By analyzing such local C-V butterfly curves, various parameters related to polarization switching can be obtained.

In this presentation, we will introduce two application examples. The first example is the characterization of a bulk single-crystal LiTaO3. In this example, we revealed that anomalous C-V curves were observed in the vicinity of domain boundaries. Such C–V curves are considered to reflect domain wall movement due to the electric field. The second example is the characterization of a HfO2-based ferroelectric thin film. Since the prepared film had random grain orientations, the shape of the observed C-V curves varied depending on the position. Parameter extraction from the obtained dataset enabled to visualize the in-plane distributions concerning the net switchable polarization amount, the intrinsic coercive field, and the local imprint.

**Keywords :** Ferroelectric thin film, Scanning probe microscopy, Domain dynamics, Lithium tantalate, Hafnium oxide