

## 4.6 Characterisation of Ferroelectric Surfaces and Ferroelectric Domains with Scanning Force Microscopy

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New efforts were made on the investigation of ferroelectric surface properties on a very local scale. Our inspection of the ferroelectric crystals TGS and BaTiO<sub>3</sub> with scanning force microscopy (SFM) allows the simultaneous investigation of topographic surface features and ferroelectric domain structures in these crystals. Specifically, non-contact and contact operation of the SFM revealed the distinct differentiation in polarization and topographic contrast.

In-situ imaging by SFM could be demonstrated also for temperatures  $T$  above the transition temperature  $T_0$  for TGS and BaTiO<sub>3</sub> ( $T_{0,\text{TGS}} = 49^\circ\text{C}$ ,  $T_{0,\text{BaTiO}_3} = 126^\circ\text{C}$ ). We directly observed transition from the ferroelectric into the paraelectric phase. Upon cooling, new domains were formed indicating no memory effect, i.e. new domains grew in other spots than before heating.

Further, a significantly different type of surface decoration was found for positively and negatively charged surface domains in TGS. This allows the in-situ observation of both domain wall motion and the nucleation of new domains.

In Fig. 2 is given one such example showing some lenticular domains with the direction of polarisation pointing into the page, while the surrounding is polarised anti-parallel. Please note the pronounced surface decoration with holes and small island in the lenticular and surrounding domains, respectively.

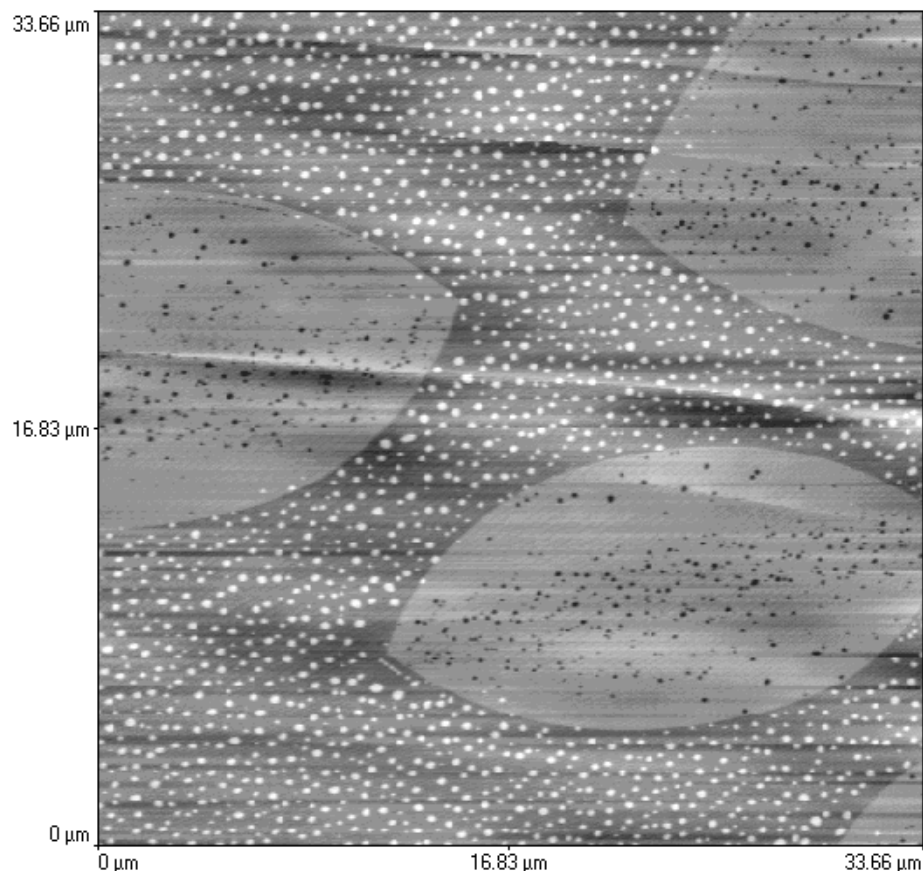


Fig. 2 Scanning force micrograph of the surface of ferroelectric TGS taken over a  $34 \times 34 \mu\text{m}^2$  surface area. Lenticular domains with the polarisation  $P$  pointing into the page are embedded in a matrix with anti-parallel polarisation. Please note the pronounced surface decoration with holes and small islands on the lenticular and surrounding domain, respectively.