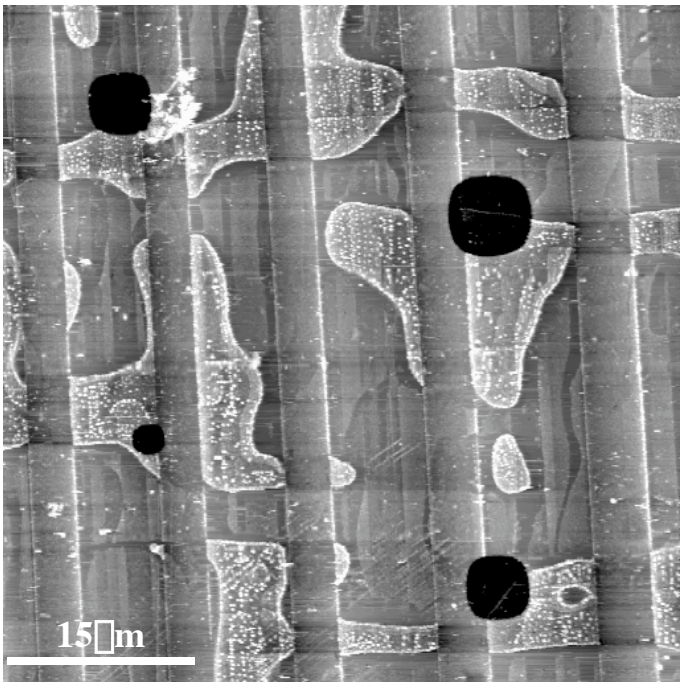
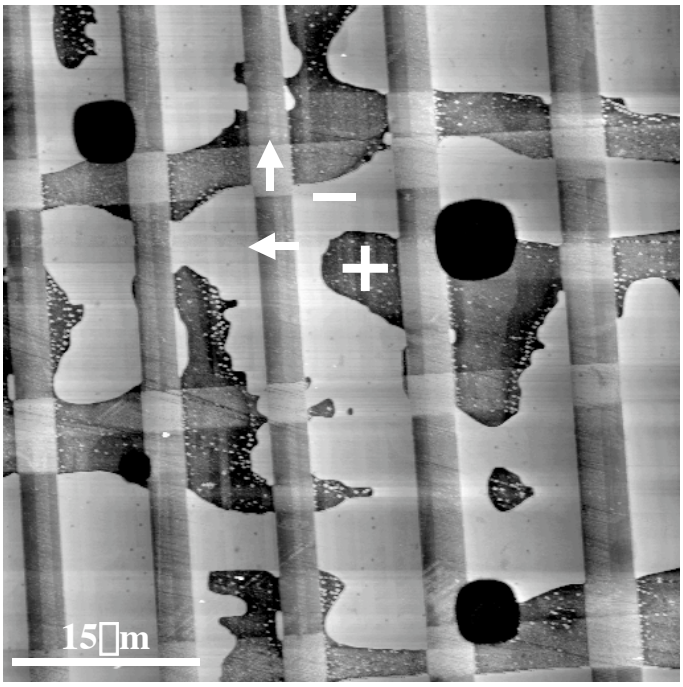
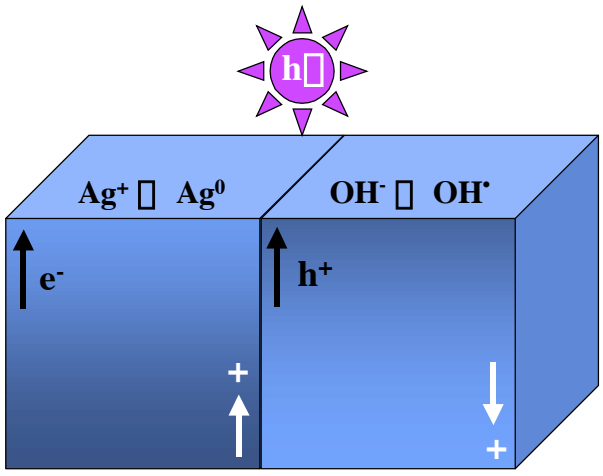
Identification of the Active $BaTiO_3$ Domains for Photochemical Reduction





Atomic Force Microscopy (AFM) was used to determine the photochemically active ferroelectric domains in $BaTiO_3$ by combining established probe reactions with known acid etch techniques. As-received {001} oriented single crystals were heated to 150°C for 10 minutes in air and then cooled to produce a domain structure.

Silver metal was photochemically reduced ($Ag^+ \rightarrow Ag^0$) on the $BaTiO_3$ surface by immersing the crystal in an aqueous $AgNO_3$ solution and irradiating for several seconds with a 300W Hg-lamp. The left-hand image shows the annealed surface after Ag reduction. The white areas on the image are the deposited silver islands and the black pits were present on the as-received crystal. Note that silver only deposits on some ferroelectric domains. The right-hand image is a micrograph of the same area after the silver was removed and the crystal was etched in a HF/HCl solution for several seconds. The domains covered with silver correspond to the domains that etched the fastest (are the darkest on the image). The silver is preferentially reduced only on domains whose polarization vector is parallel to the surface normal.



Jennifer L. Giocondi and Gregory S. Rohrer
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