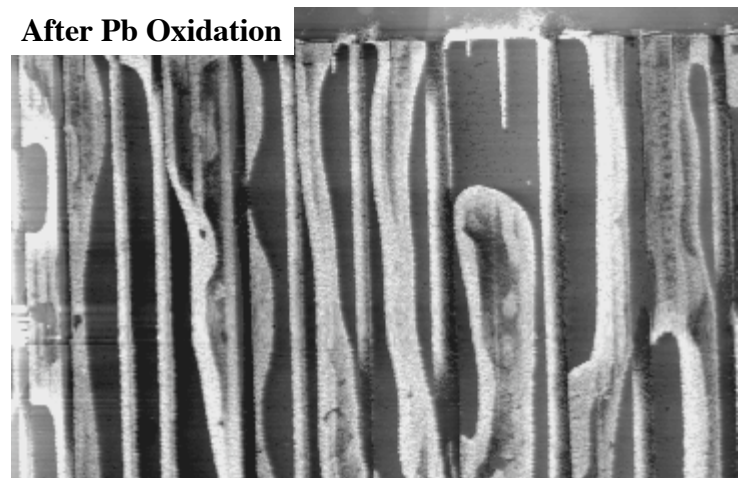
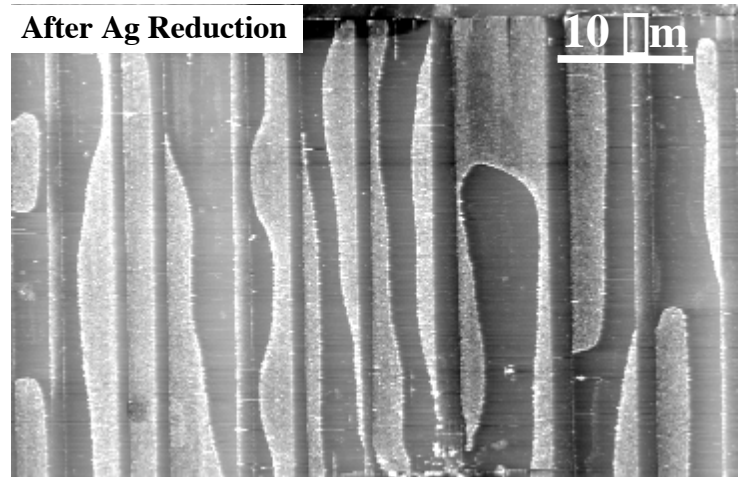


How Does Domain Polarization Affect Photochemical Reactions?

Atomic Force Microscopy (AFM) was used to determine if photochemical oxidation and reduction reactions occur at separate locations on the surface of ferroelectric BaTiO₃. Silver was photochemically reduced ($\text{Ag}^+ \rightarrow \text{Ag}^0$) on a {100} BaTiO₃ surface by immersing the crystal in an aqueous AgNO₃ solution and irradiating for several seconds. The top AFM topograph shows the surface after silver reduction. Note that Ag⁰ islands (white contrast) accumulate on only some of the ferroelectric domains.

After removing the silver deposits, lead was photochemically oxidized ($\text{Pb}^{2+} \rightarrow \text{Pb}^{4+}$) on the same BaTiO₃ surface from an aqueous lead acetate solution. The white contrast in the bottom AFM topograph corresponds to PbO₂ deposits. Note that PbO₂ and Ag⁰ deposits are located on complementary domains separated by 180° boundaries. Therefore, photochemical oxidation reactions occur on domains with the opposite polarization from those that promote photochemical reduction reactions. An acid etch was used to assign the polarization directions indicated in the schematic below.



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