Crack Propagation due to Electrical Cycling

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It has been known for 10 years that a bipolar electrical loading in a ferroelectric material can lead to crack propagation due to the electromechanical coupling. In this talk we describe a measurement technique using through-thickness cracks in DCB specimens to quantify crack propagation for different numbers of electrical cycling. Of interest are specifically the crack/specimen geometry, the amplitude, and the frequency of the electrical field. Depending on experimental conditions different crack propagation behaviour can be observed: pop-in from a notch, steady state propagation of one crack, or evolution of a damage zone with extensive crack branching. These crack extension regimes are described along with a steady state propagation behaviour for different electrical amplitudes. The crack propagation behaviour is compared with R-curves resulting from mechanical loading in different crack/specimen geometries.