**Sonderforschungsbereich 595**

**Elektrische Ermüdung in Funktionswerkstoffen**

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# A two-scale homogenization procedure for electromechanically coupled ceramics

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Ferroelectric materials exhibit a spontaneous polarization, which can be reversed by an applied electric field of sufficient magnitude. The resulting nonlinearities are expressed by characteristic dielectric and buttery hysteresis loops. These effects are correlated to the structure of the crystal and especially to the axis of the spontaneous polarization in case of single crystals.

On our representative meso scale we assume that the domains consist of unit cells with equal spontaneous polarization. Each domain is modeled within a coordinate invariant formulation for an assumed transversely isotropic material as presented in [2], in this context see also [1]. In this investigation the macroscopic polycrystalline quantities are obtained via a simple homogenization procedure, where discrete orientation distribution functions are used to approximate the different domains.

[1] J. Schröder and D. Gross, “Invariant Formulation of the Electro-Mechanical Enthalpy Function of Transversely Isotropic Piezo-Electric Materials”, Archive of Applied Mechanics **73**, 533-552 (2004).

[2] J. Schröder and H. Romanowski, “A thermodynamically consistent mesoscopic model for transversely isotropic ferroelectric ceramics in a coordinate-invariant setting”, Archive of Applied Mechanics **74**, 863-877(2005).