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Mechanik-Seminar

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Thema:	**"Micro-Macro Modelling Approaches on Nonlinear Behaviour of Ferroelectric Materials"**
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Abstract:

An active or "smart" material is often defined as one that gives an unexpected response to an input, for example, an electrical or magnetic response to a mechanical or thermal input. In the field of engineering, active materials of interest are those which can be in modern structural design and intelligent systems. Ferroelectric materials represent an important class of active materials for applications as transducers, actuators, and sensors. These materials have unique properties as compared to traditional engineering materials such as their constitutive bevhaviour involves the electromechanical coupling which makes to serve as smart materials. Ferroelectric ceramics are widely being used in a various range of applications as MEMS devices, FRAM (ferro-electric random access memories), nanopositioning, active damping, ultrasonics and so forth. Under the action of low electric fields or low mechanical stresses, the behaviour of the materials of interest is almost linear but exhibits strong nonlinear response under high electric fields or mechanicals stresses, respectively. Domain switching effects are accepted to be the main source for this highly nonlinear behaviour, stemming from reorientation of the underlying polarization directions with respect to the applied loading directions. To study the nonlinear dissipative effects of ferroelectric polycrystals a micro-mechanically motivated model is developed based on firm thermo- dynamics principles. Thermodynamically consistent Gibbs free energy by means of energy-based criterion is adopted for the initiation of domain switching processes. The key aspect in modelling, that is the constraint imposed by the surrounding grains on a grain at its boundary, which is so-called grain-boundary effects are incorporated; by means of micro-macro-mechanically motivated concept. The simulated numerical results show appreciable improvement in modelling the nonlinear response for ferroelectrics subjected to various loading aspects compared with the measured data from the literature.

Alle Interessenten sind herzlich eingeladen.
Prof. Dr.-Ing. Wolfgang Seemann