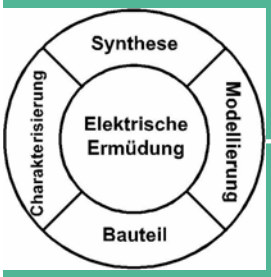

Sonderforschungsbereich 595

Elektrische Ermüdung in Funktionswerkstoffen

TECHNISCHE UNIVERSITÄT DARMSTADT

Sonderkolloquium im WINTERSEMESTER 2009/2010

30. 12. 2009

Prof. Mark Hoffman

School of Materials Science and Engineering, The University of New South Wales, Sydney

Domain Switching Behaviour in Ferroelectric ceramics under Mechanical and electrical Cyclic loading

Ferroelectric ceramics are widely used in actuator and sensor applications because of the unique ability these ceramics to convert electrical energy into mechanical energy and vice versa. This property, the so-called piezoelectric effect, is caused by the change of polarisation or crystal domain switching due to an external applied load. Ferroelectric components usually experience mechanical and/or electrical cyclic loading during operation. Under a long period of a cyclic loading, the ability of domains to switch decreases leading to malfunction of the devices. Moreover, the degree of degradation of domain switchability depends on the condition of loading such as cyclic amplitude and frequency.

In the present work, the relationship between the loading frequency and domain switching behaviour was probed using a state-of-the-art neutron diffractrometer and high spatial resolution synchrotron X-rays. The frequency effect on domain switching behaviour under mechanical loading was extracted from neutron diffraction data. The results show that ferroelastic strains caused by domain switching became saturated with increasing of number of cycles. Furthermore, the level of saturation is higher at a lower frequency. In the case of electrical loading, the frequency effect on a domain switching zone around the crack tip was revealed using synchrotron X-rays. The switching zone is larger if the loading frequency is lower. Moreover, it was found that crack propagation is more severe at a lower electrical loading frequency.

In this work, viscoelastic models were used to explain the frequency effect on domain switching behaviour.

Der Vortrag findet um **11:00** im Gebäude der Materialwissenschaften, Lichtwiese, Petersenstr. 23, **Raum 77** statt

Darmstadt, 28.12.2009