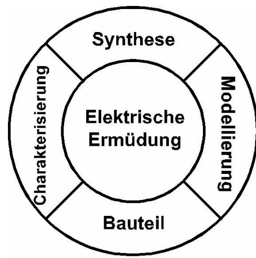

Sonderforschungsbereich 595

Elektrische Ermüdung
in Funktionswerkstoffen

TECHNISCHE
UNIVERSITÄT
DARMSTADT

SFB 595 Kolloquium
in cooperation with GRK 1037

05. Juli 2007, 14.45 Uhr

Gebäude der
Materialwissenschaften

Raum 77

Leakage currents through metal/insulator/metal (MIM) thin film capacitor stacks

Prof. Herbert Schroeder

Institut für Elektronische Materialien im Institut für Festkörperforschung (IFF-6)
and cni – Center of Nanoelectronic Systems for Information Technology,
Forschungszentrum Jülich GmbH

The present understanding of steady state leakage currents through metal/insulator/metal thin film (MIM) capacitor stacks with high permittivity dielectrics or ferroelectrics will be reviewed. Such capacitor stacks have gained increasing attention because of possible future applications in dynamic random access memory (DRAM) devices or as new gate (oxid-)materials in metal-oxid-semiconductor field-effect transistors (MOSFET).
The first part consist of a discussion of the experimental conditions to measure the *true* leakage current and from that, necessary conditions will be extracted to create reliable leakage current data for mechanistic studies. In the second part the most common leakage current mechanisms will be introduced with special emphasis on the characteristic parameters for experimental verification. The third part will give some selected examples of experimental data and possible difficulties in identifying the controlling mechanism. In a fourth part a (new) model is offered combining carrier injection by thermionic emission and/or tunnelling at the electrode interface with the transport properties of the film bulk, which can be described by drift and diffusion with an effective mobility/diffusivity such as band or large-polaron conduction. Model simulation results are compared to experimental data.
In a last part a new non-volatile memory device, the current controlled resistive RAM (possibly replacing the volatile DRAM) will be introduced and described.