Sonderforschungsbereich 595

Elektrische Ermüdung
in Funktionswerkstoffen

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SFB 595 Kolloquium

21. Juni 2007, 16.15H

Gebäude der Materialwissenschaften

Raum 77

Datum: 21. Juni 2007

The role of point defects in diffusion processes of oxides

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Oxides play an ever increasing role as advanced functional materials. Examples are tarnishing layers during high temperature oxidation, oxygen ion conducting oxides in high temperature fuel cells, mixed conducting oxides in oxygen permeation membranes, lithiumoxides for batteries, high temperature superconductors, ferroelectrics, catalysts etc. The oxides that are used are complex oxides, i.e. they contain normally several cations and they exist in complicated crystal structures with several sublattices. The properties of these oxides are determined to a large extent by the thermodynamics and kinetics of point defects. Basic research concerning defect chemistry, transport properties and chemical reactivity is the basis for the improvement and optimization of functional materials.

In our research we are using the following techniques: Thermogravimetry, in situ X-ray diffraction, in situ X-ray absorption spectroscopy, radiotracer diffusion, secondary ion mass spectrometry (SIMS), electron microscopy with chemical analysis (SEM/EDX), impedance spectroscopy, computer simulation and modeling, density functional theory.

We are interested in the following topics: non-stoichiometry, cation and oxygen diffusion, tracer diffusion, electrical conductivity, oxidation kinetics, heterogeneous catalysis, solid oxide fuel cells.