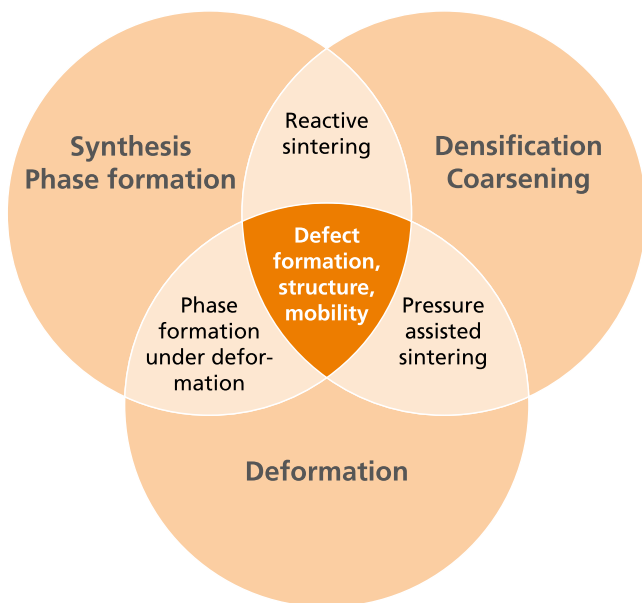


OBJECTIVES

The DFG Priority Programme SPP 1959 is a world-wide unique, coordinated, major research effort, funded for a period of six years. SPP 1959 was started in September 2016 to extend the current level of understanding on how to influence or tailor materials microstructures by the use of external fields. An objective is a unified description of matter transport activated in inorganic solid materials by electric and magnetic fields.



Within SPP 1959, 14 projects are providing a fundamental basis built on experimental evidence for understanding how atoms, ions, electrons and defects are affected by external fields, and for intentionally using electromagnetic energy for materials synthesis and processing. Investigations are accompanied by systematical theoretical modelling and computational simulation on different length scales.

COORDINATION

The programme committee is responsible for the conception and the steering of the priority programme:

- | | |
|---------------------|--|
| Christian Elsässer | Albert-Ludwigs-Universität Freiburg / Fraunhofer IWM |
| Olivier Guillon | Forschungszentrum Jülich / RWTH Aachen University |
| Oliver Gutfleisch | Technische Universität Darmstadt |
| Jürgen Janek | Justus-Liebig Universität Gießen |
| Sandra Korte-Kerzel | RWTH Aachen University |
| Cynthia A. Volkert | Georg-August-Universität Göttingen |

DFG Priority Programme SPP 1959



The coordination team is responsible for the implementation of the priority programme, as well as the coordination of the participating projects.



Olivier Guillon



Doris van Balen



Falk Schulze-Küppers

Manipulation of Matter Controlled by Electric and Magnetic Fields:

Towards Novel Synthesis and Processing Routes of Inorganic Materials

www.fieldsmatter.de

Contact:

Forschungszentrum Jülich GmbH
Institute of Energy- and Climate Research (IEK-1)
52425 Jülich, Germany
Phone: +49 (0)2461 61-96944
Email: d.van.balen@fz-juelich.de

www.fieldsmatter.de

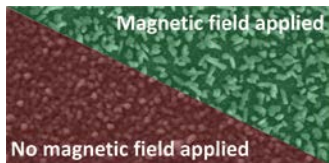


A Priority Programme funded by the

DFG Deutsche Forschungsgemeinschaft

Topic 1: Synthesis and Phase Control

Electric and magnetic field processing are effective tools to control the structural and functional properties of materials. Therefore the impact of magnetic and electric fields and current on defects, phase



Influence of magnetic field on film growth and topography.

transformation, solid state reactions and microstructure is investigated in this topic.

Topic 2: Densification and Coarsening

Technologies, such as electric and magnetic field assisted sintering, offer the possibility to produce materials that are extremely difficult, if not impossi-

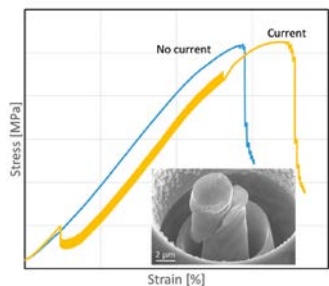


Field assisted sintering of a high temperature material.

ble, to obtain by conventional methods. The impact of fields on densification, microstructure and material properties is investigated here.

Topic 3: Mechanical Deformation

This topic focuses on the electro- and magneto-plastic effects. The use of fields can indeed change the



mechanical behavior of solids dramatically and can potentially reduce processing time and temperatures.

Influence of current on mechanical deformation.

Topic 1: Synthesis and Phase Control

M. Martin, J. Chun: *“Kinetic unmixing and kinetic decomposition of oxides in external electric fields”*

Rheinisch-Westfälische Technische Hochschule Aachen

W. Tremel, M. Lange, I. Veremchuk: *“Spark Plasma Sintering = Spark Plasma Synthesis”*

Johannes Gutenberg-Universität Mainz,
Max-Planck-Institut für Chemische Physik fester Stoffe

O. Gutfleisch, F. Maccari, C. Elsässer: *“Processing of magnetic materials enhanced by magnetic or electric fields or currents”*

Technische Universität Darmstadt,
Albert-Ludwigs-Universität Freiburg

A. Voigt, R. Backofen: *“The Influence of Electric and Magnetic Fields on Microstructure in Multiferroic Composite Materials – a Phase-Field-Crystal Approach”*

Technische Universität Dresden

M. Sierka, M. Becker, A. Szeghalmi, V. Beladiya: *“Manipulating Material Properties of Atomic Layer Deposited Oxide Thin Films by Electric Field: Experimental and Computational Design (ALDBIAS)”*

Friedrich-Schiller-Universität Jena

S. Mathur, T. Fischer, D. Stadler: *“External Magnetic Field Effects on Chemical Vapor Deposited Transition Metal Oxides (EMAGINE)”*

Universität zu Köln

Topic 2: Densification and Coarsening

O. Guillon, C. Cao, R. Dunin-Borkowski, Z. Ma, R.A. De Souza, J. Parras: *“Electric field assisted diffusion and sintering of polycrystalline ceria”*

Rheinisch-Westfälische Technische Hochschule Aachen,
Forschungszentrum Jülich GmbH

C.A. Volkert, V. Roddatis, D. Schwarzbach: *“In-Situ Electron Microscopy Studies of Electric Field Assisted Sintering of Oxide Ceramics”*

Georg-August-Universität Göttingen

M.J. Hoffmann, W. Rheinheimer, P. Gumbsch, A. Lehner, J. Preusker: *“Impact of electric fields on grain growth in strontium titanate”*

Karlsruher Institut für Technologie

M. Winterer, C. Gorynski, D. Wolf, L. Engelke, M. Jongmanns: *“Pattern Formation during Current Sintering”*

Universität Duisburg-Essen

R. Kirchheim, C.A. Volkert, T. Brede: *“The impact of high current densities on the microstructure of nanocrystalline iron-based alloys and related effects during spark plasma sintering of these alloys”*

Georg-August-Universität Göttingen

C. Broeckmann, S. Sistla, M. Bram, T. Mishra: *“Field assisted sintering of rare earth doped ceria”*

Rheinisch-Westfälische Technische Hochschule Aachen,
Forschungszentrum Jülich GmbH

Topic 3: Mechanical Deformation

G. Gerstein, F. Körkemeyer, S. Zaefferer, A. Tripathi: *“Micromechanisms of the electro-plastic effect in magnesium alloys investigated by means of electron microscopy”*

Gottfried Wilhelm Leibniz Universität Hannover,
Max-Planck-Institut für Eisenforschung GmbH

S. Korte-Kerzel, S. Sandlöbes, D. Andre, P. Shanthraj: *“Electro-plastic deformation of Al-Cu eutectic alloys”*

Rheinisch-Westfälische Technische Hochschule Aachen,
Max-Planck-Institut für Eisenforschung GmbH