

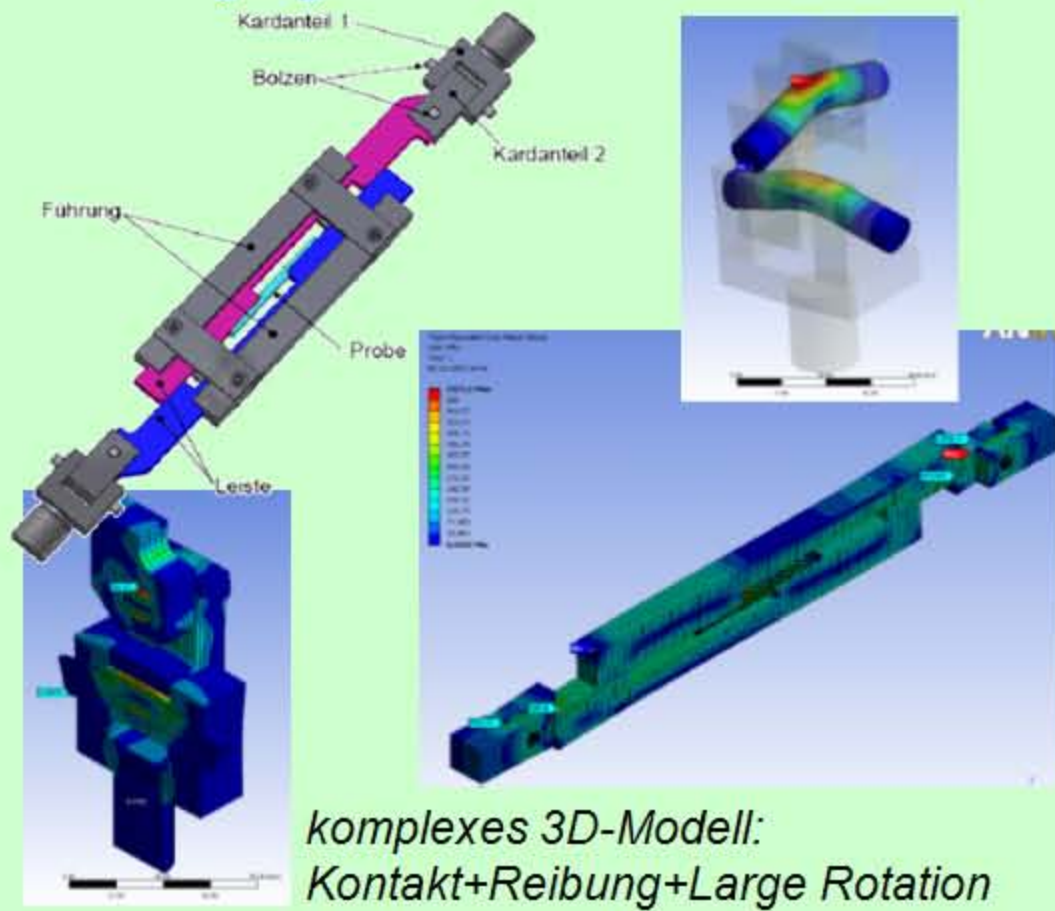
AG Modellierung und Simulation (OE 422)

- Personal:** 5 MA: Beckert, Freytag, Ganzer, Schöne, Dannowski
- Hardware:** **Linux-W's** (8-32 GB-RAM, 2x2-4Core CPU, ...), **Win64 W's** (4-8 GB, 2-4 Core CPU's)
- Software:** **Multiphysics FEM:** ANSYS, COMSOL, FlexPDE, DiffPack
CFD: Fluent, (ANSYS CFX, CosmosFloWorks)
Systemsimulation: Matlab/Simulink, SimulationX
Sonstige: Mathematica, C++
- Methoden:** **Multiphysics-FEM, Homogenisierung** heterogener Strukturen, **CFD, Systemsimulation**
- Themen:** **Brennstoffzellensysteme/ Komponenten**
therm. Auslegung keramischer Bauteile
thermomech. Analyse keram. Bauteile
Bauteile mit gekoppelten Phänomenen ...

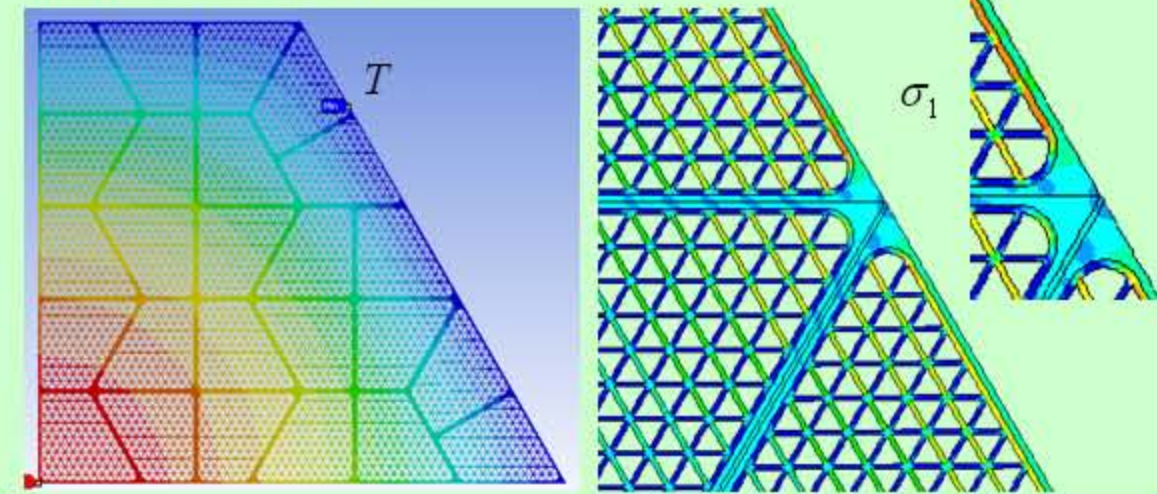
Thermo-mechanische Analyse von (keramischen) Bauteilen

Auslegung Probenaufnahme, Auslegung keram. Federn, Optim. keram. Wärmestrahlkörper, Belastung Extrusionsmundstück, ...

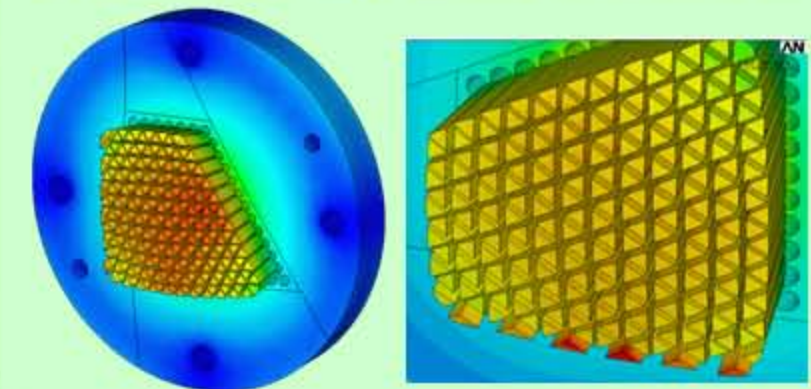
Auslegung Probenaufnahme Schertest



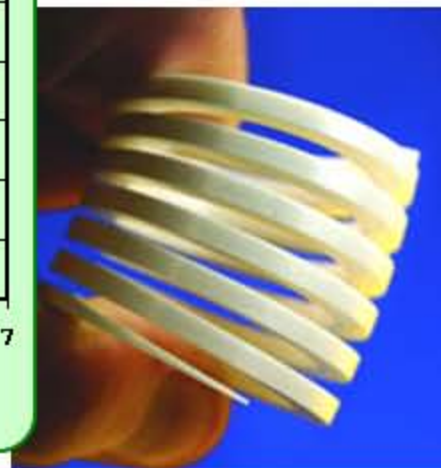
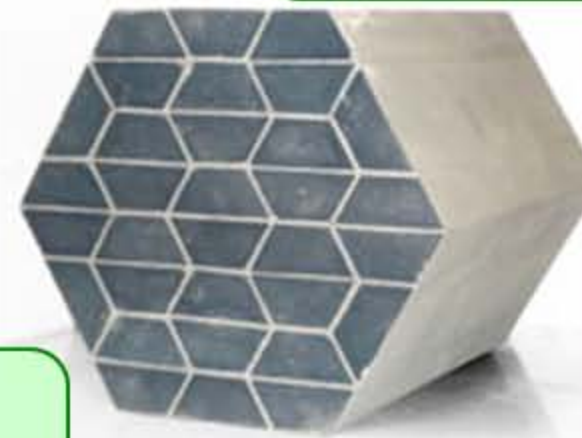
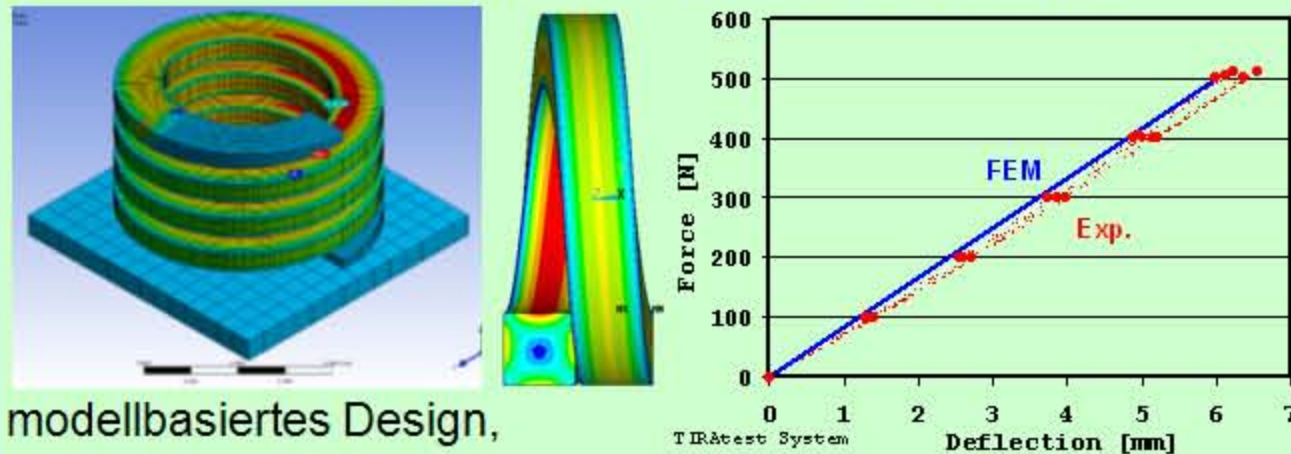
Thermomech. Beanspruchung DieselPartikelFilter thermo-mechanisch



Deformation Extrusions-Mundstück



Dimensionierung keramische Schraubenfeder

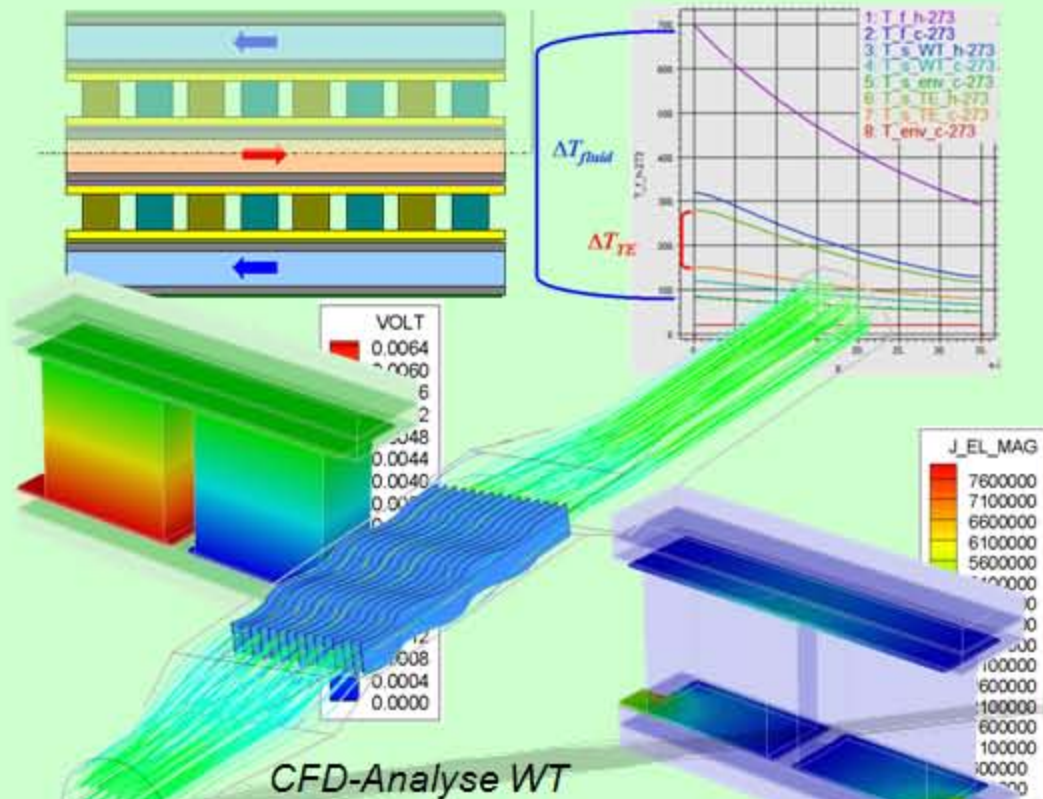


OE422

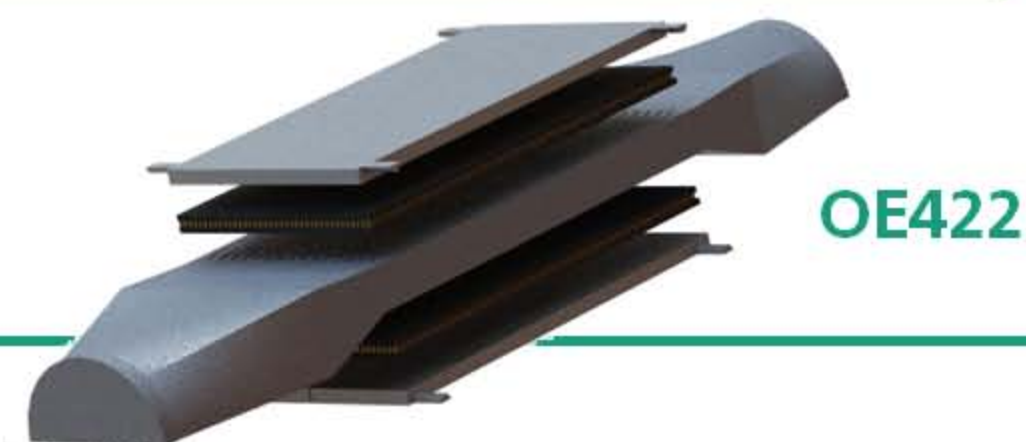
Analyse von Bauteilen/Strukturen mit gekoppelten Phänomenen

Performance piezoelektr. Composite-Aktuatoremodule, Machbarkeitsanalyse ferroelektr. Druckwalze, Modell. thermoelektr. Bauteile, Simul. elektrochem. Strömungs-Zelle...

Wiederholeinheit thermoelektrisches Modul Integr. Modell thermoelektrischer Generator

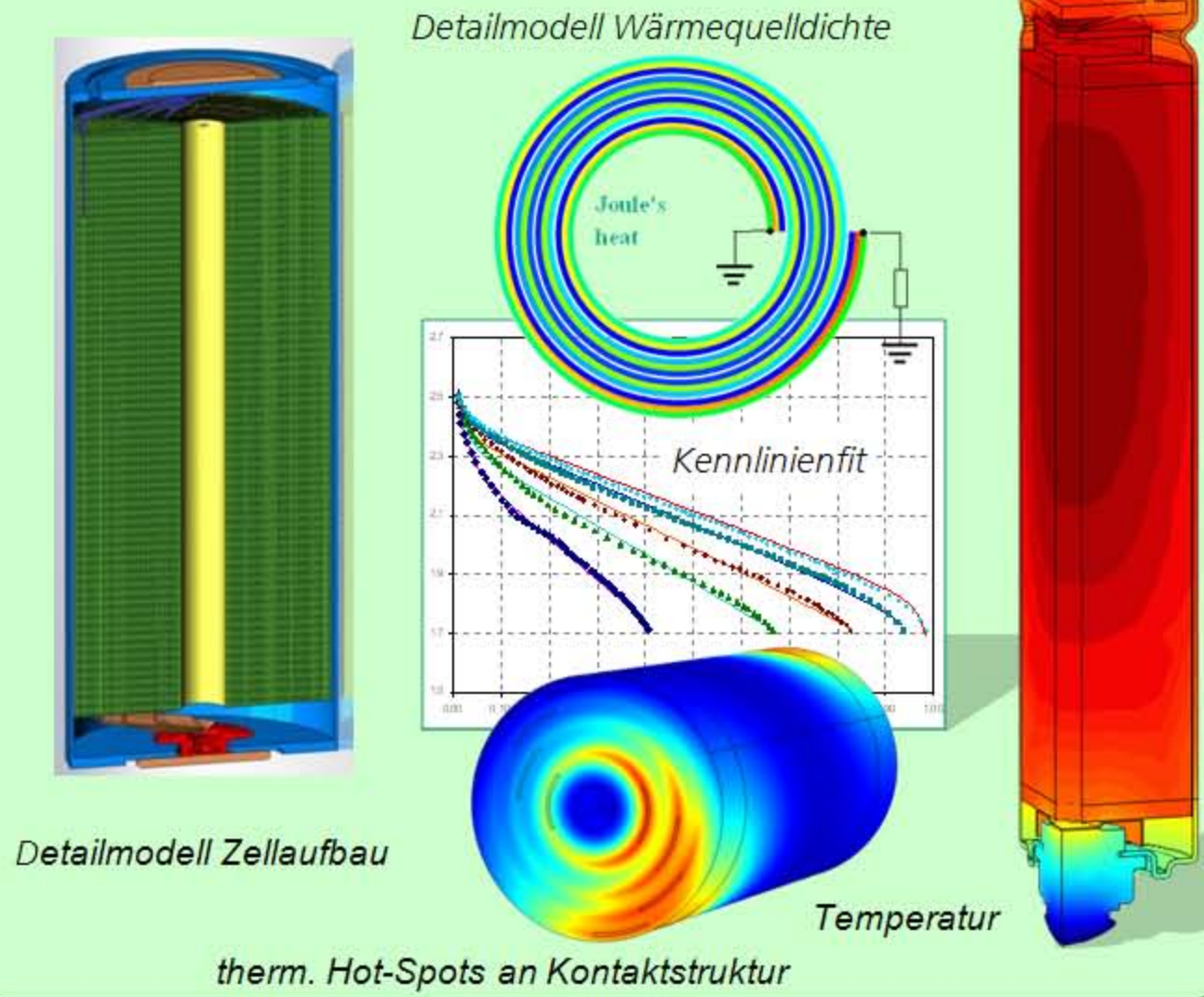


userdefin. Physik, gekoppelte Beschreibung
FE bzw. CFD-Codes: Comsol, FlexPDE, Fluent



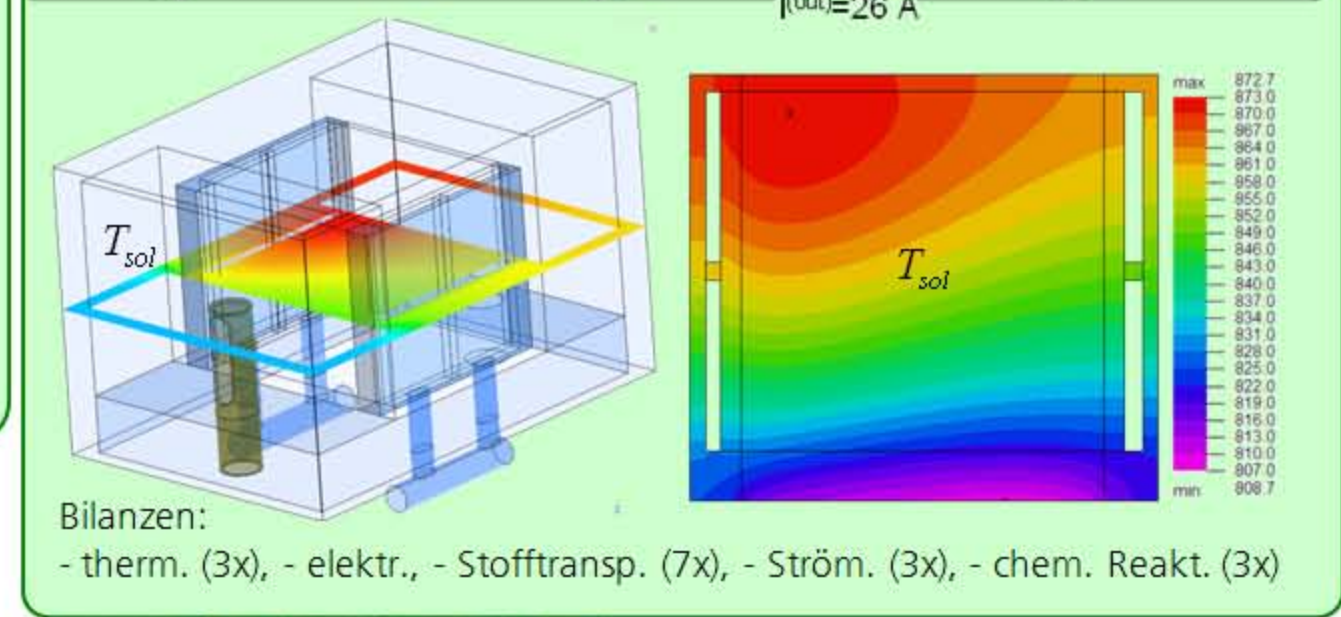
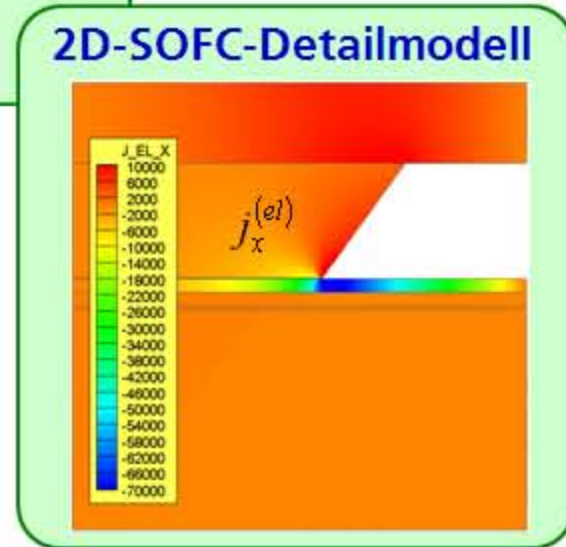
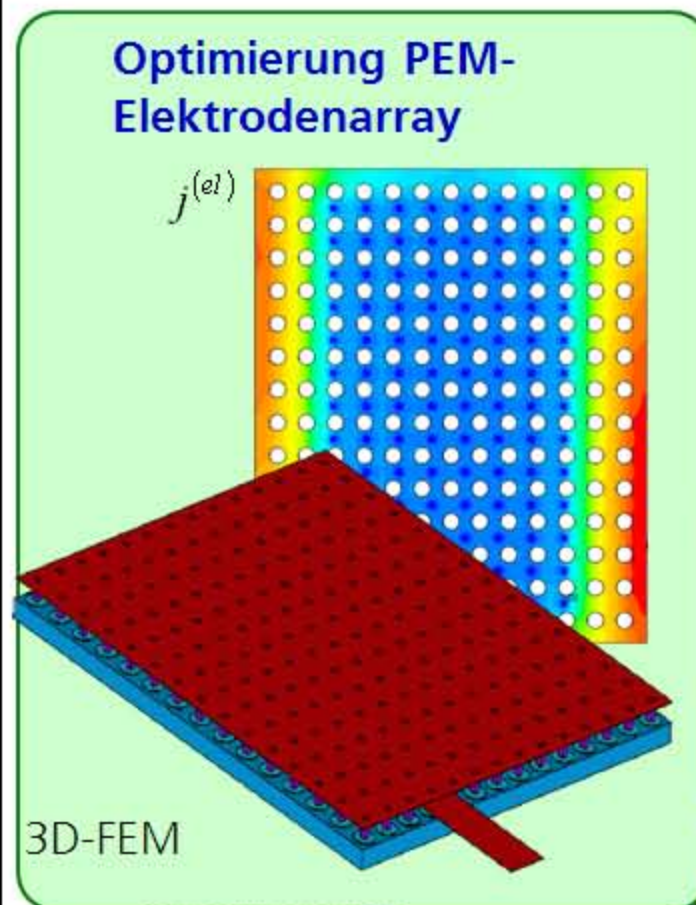
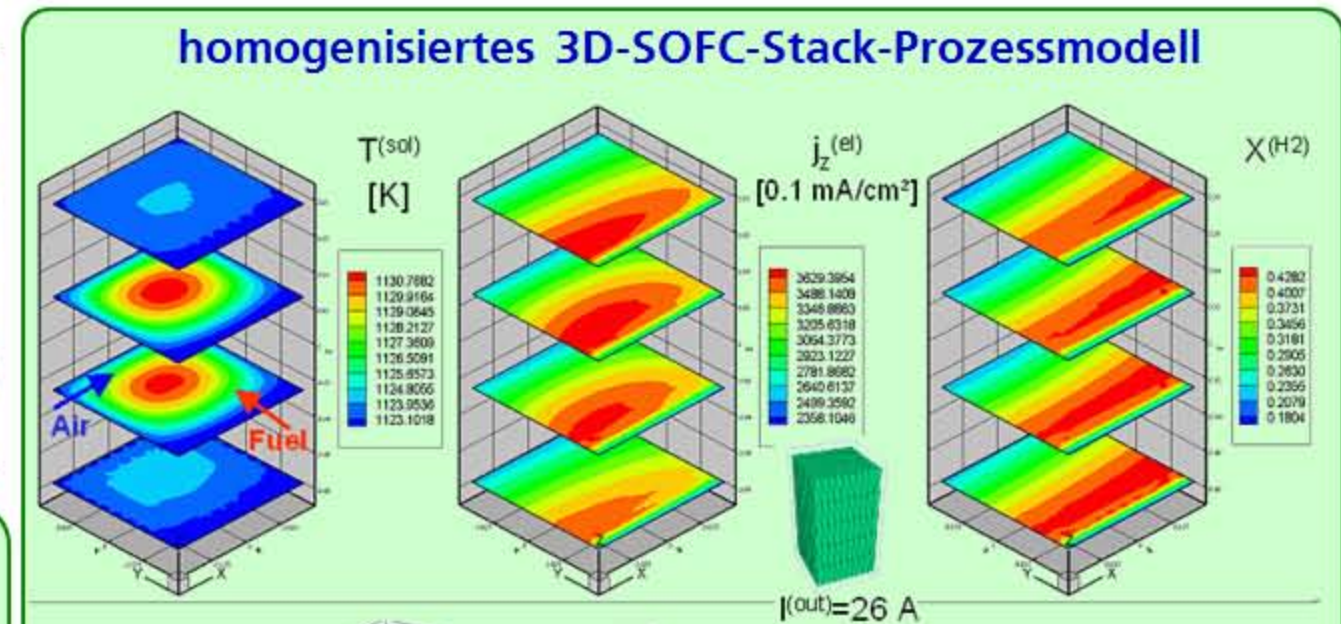
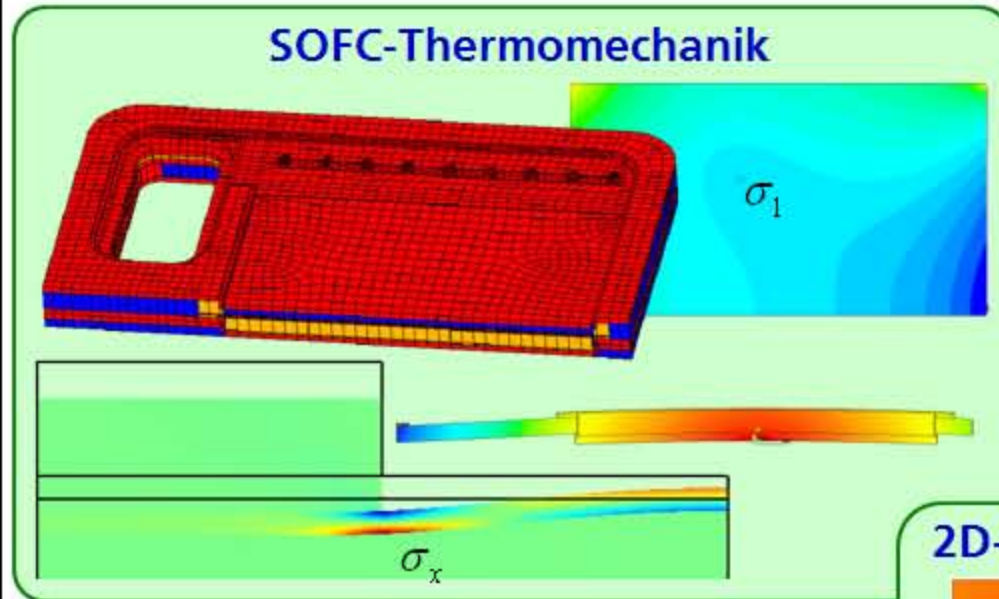
Modell therm. Management Lithium-Batterie

- therm.-elektr. FE-Modell (Comsol)
- empirisches Modell für el.-chem. Verhalten
- Wicklungsbereich: homogenisierter Komposit (2 DOF elektr. + 1 DOF therm. + el.chem. Quellterm)



Modellierung von Brennstoffzellen-System-Komponenten

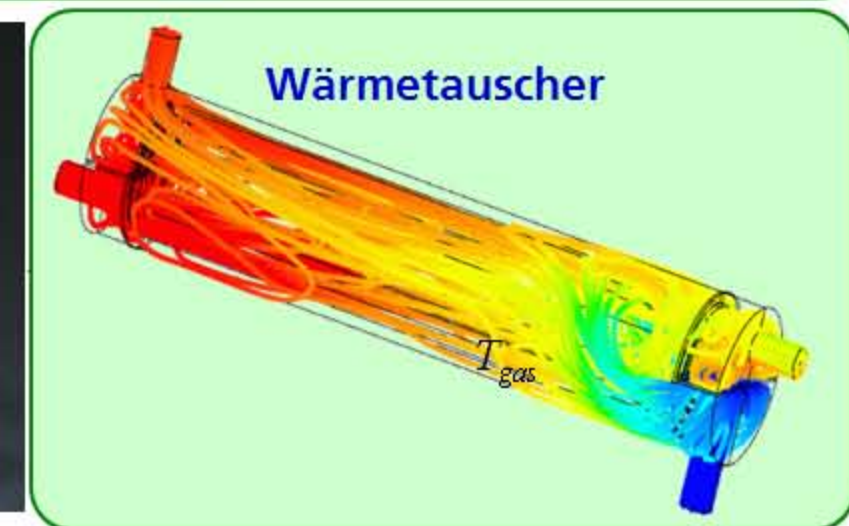
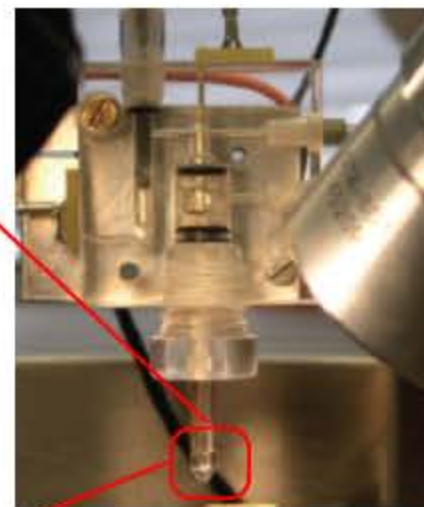
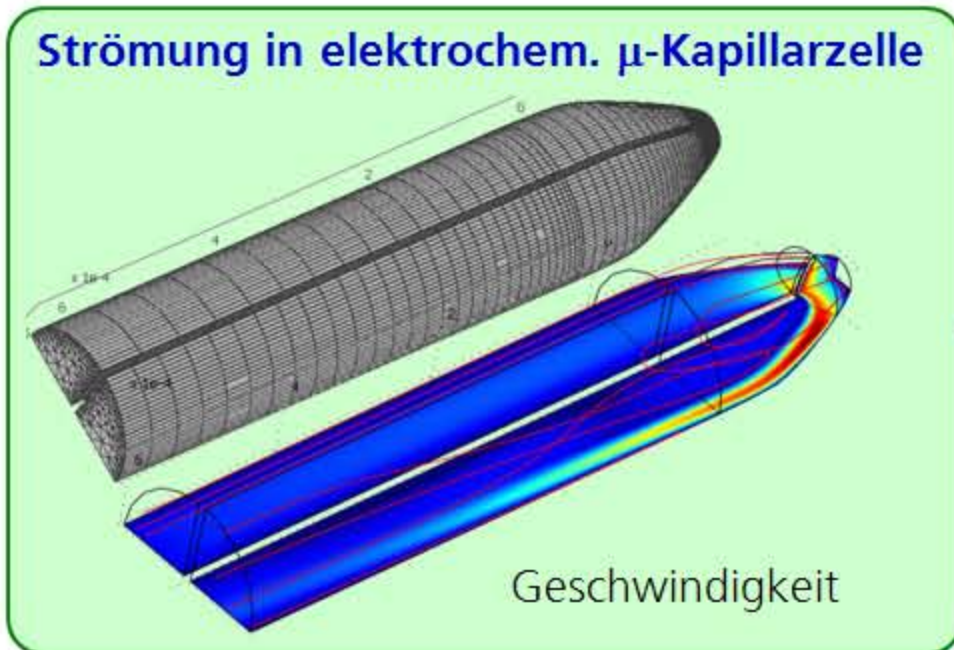
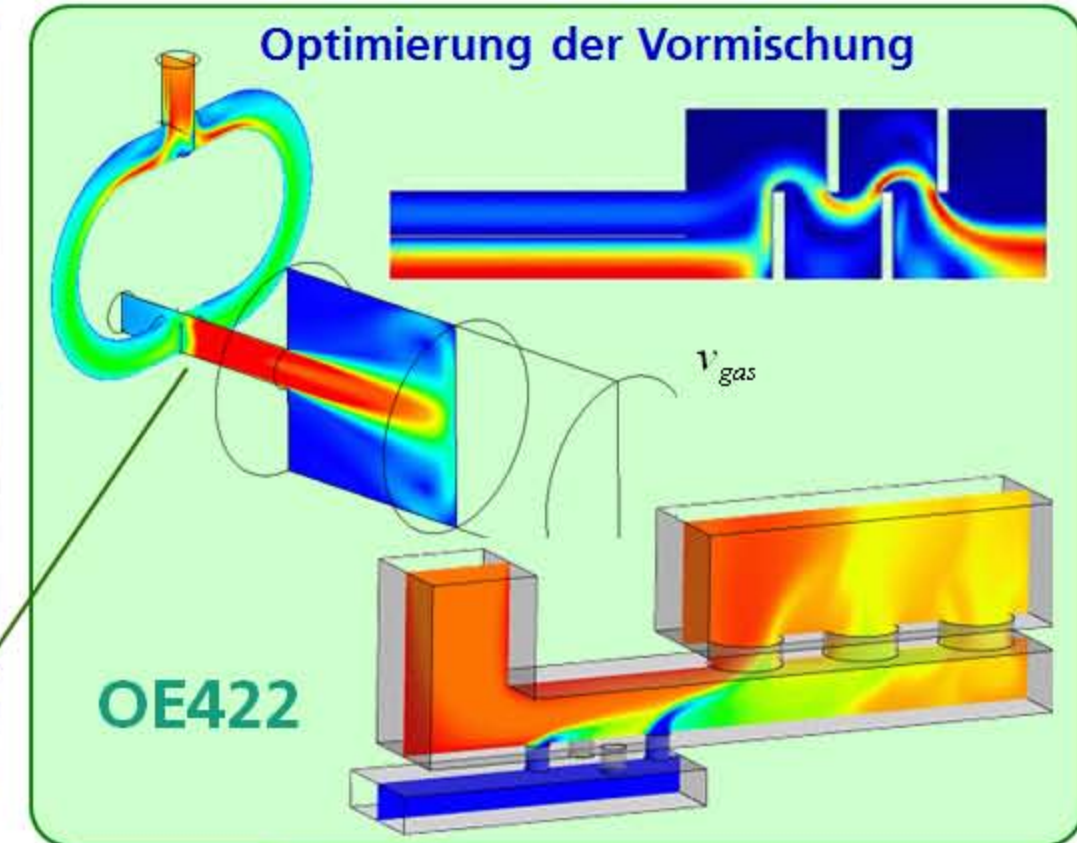
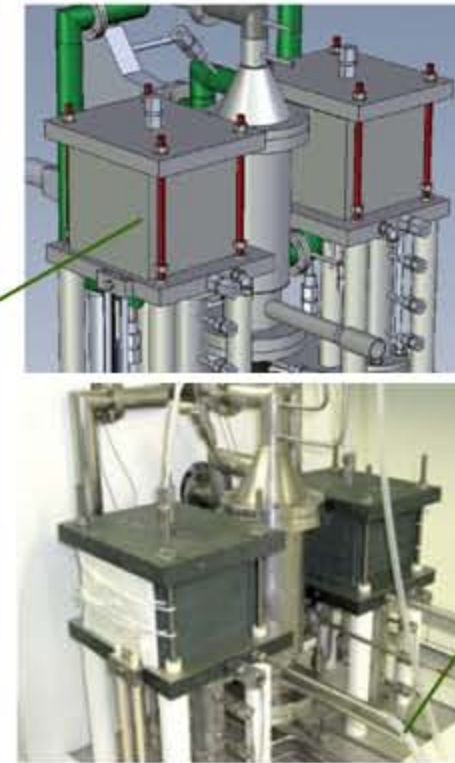
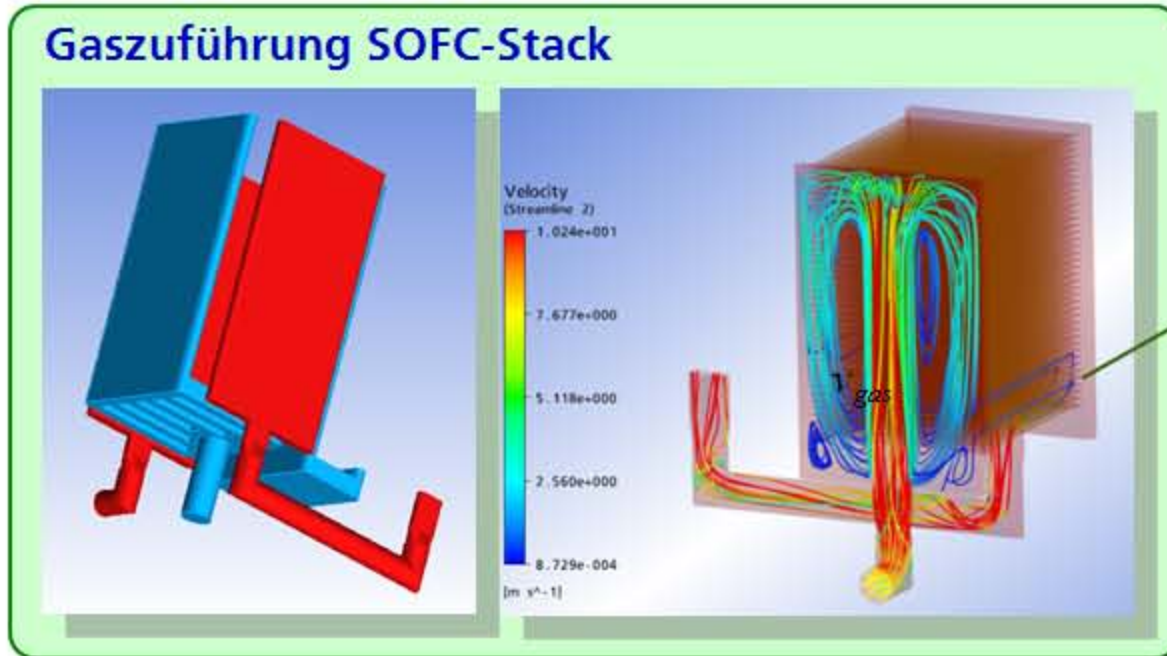
Brennstoffzellen-Modellierung: 3D-SOFC-Stack-Modell, 2D-Strukturmodell SOFC-Zelle, thermomech. Belastung MEA im SOFC-Stack, dynam. Modell Aufheizung/ Betrieb integrierter SOFC-Module, Optimierung μ -PEM-Elektrodenstruktur, ...



OE422

Strömungssimulation

Optimierung d. Vormischung für BZ-System-Reaktoren (Nachbrenner, Reformer), Optim. Gaszuführung SOFC-Stack, Modell μ -PEM-Flowfield, Optim. HT-Wärmetauscher, Modell Durchströmung el. chem. μ -Kapillarzelle, ...



Modellierung reaktiver Strömungen in porösen Strukturen

Modell. SOFC-System-Reaktoren (Nachbrenner, Reformer, ...), Optim. Rußpartikelfilter-Struktur, ...

Reaktoren

T_{sol}

Component Molar Ratio

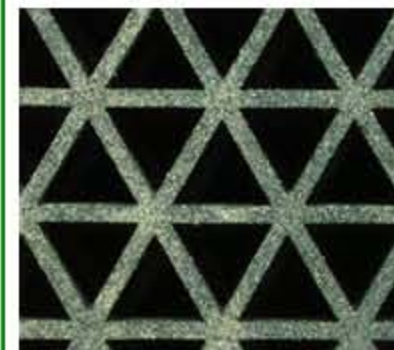
$X_k(x)$

Ziele:
 therm. Belastung
 Homogen. Umsatz

CFD + Stofftransport 7 Spezies + chem. Reaktionen
 +thermische Bilanzen (2x)



OE422



Modell Rußpartikelfilterstruktur

Vergleich Strukturvarianten, Geom.einfluß, Rußablagerung

$P_{in/out}(x)$

channel pressure [Pa]

Druckverlauf

axial position z [m]

Einheitszellen-Analyse

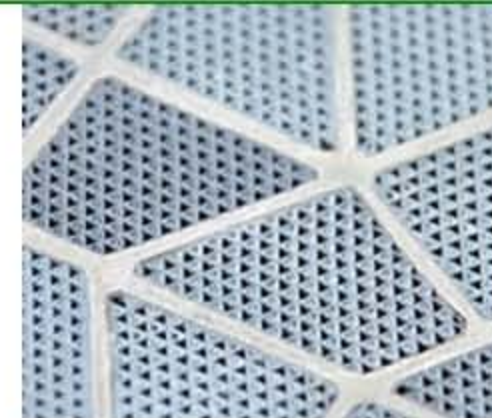
Rußablagerung

Druck [mbar]

NTF 320; 6Zoll; Messung 6.3

— Messung
 • FEA 4
 • FEA 3

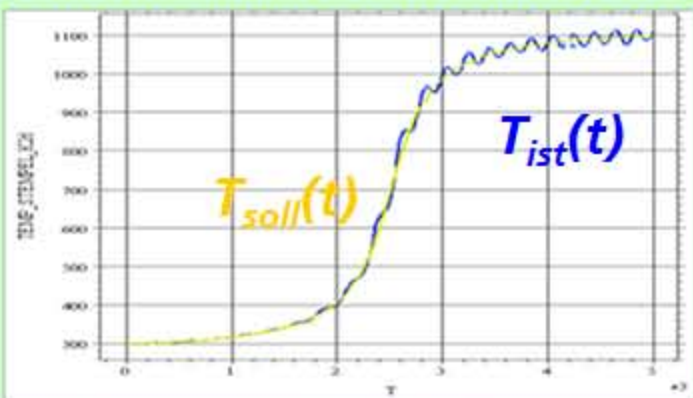
depth filtration
 soot cake growth



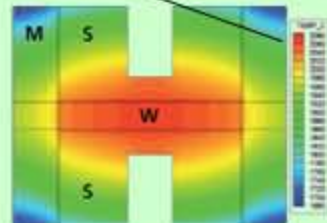
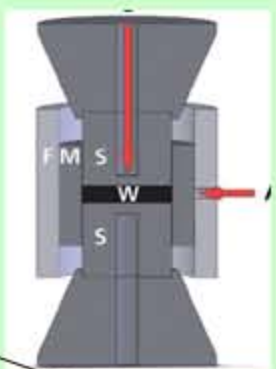
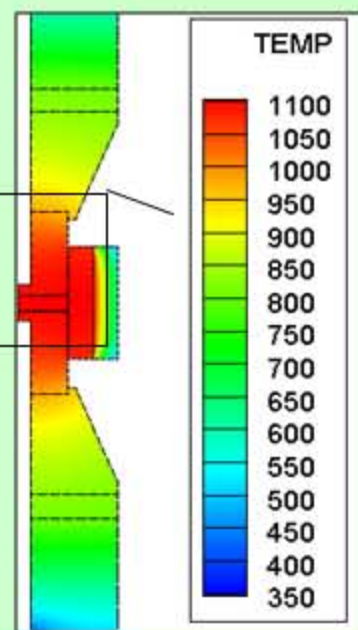
Auslegung/Optimierung integrierter Heizstrukturen

O₂-Sensor, CO₂-Sensor, FAST-SPS-Prozess, Auslegung/Optim. keramischer Glühkerzen, ...

Modell Field Assisted Sintering Anlage

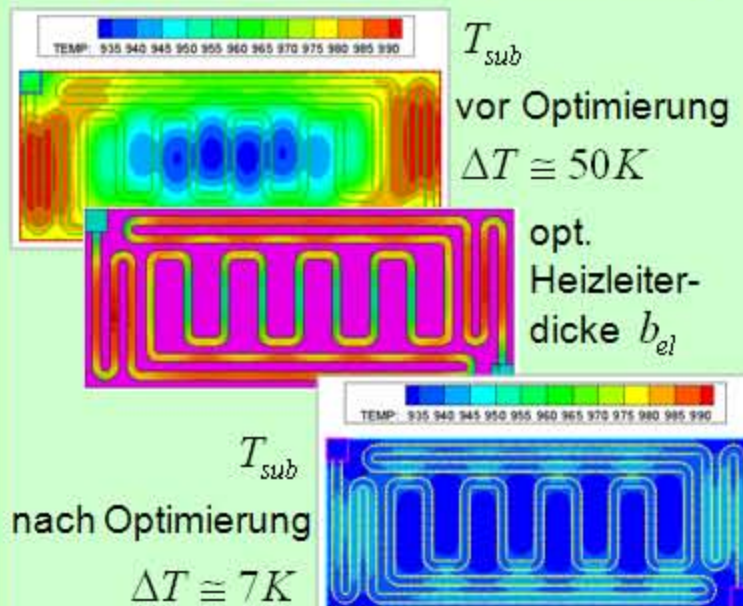


thermo-elektrische Kopplung
„moving mesh“
integrierte Temperatur-Regelung

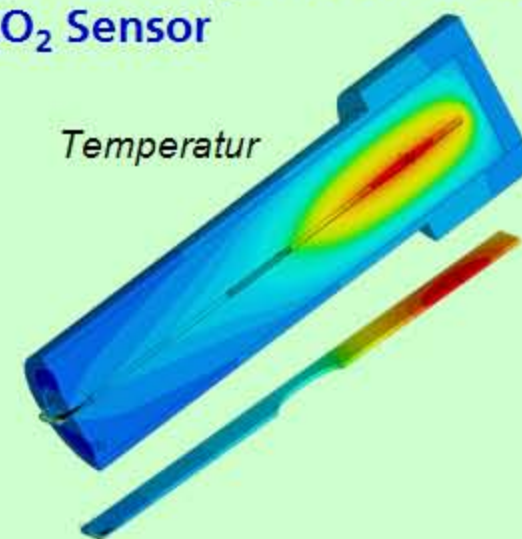


OE422

Sensorheizungs-Optimierung



Optimierung Heizstruktur CO₂ Sensor



Glühkerze

