A Detailed FE Model for the Simulation of MIEC Cathode Microstructure

T. Carraro

Universität Karlsruhe, thomas.carraro@kit.edu

The application of mixed ionic / electronic conducting (MIEC) materials as cathode for solid oxide fuel cells enables mid- to low-temperature operation. The cathode efficiency depends on both material composition and microstructure. Models implementing material parameters and structural parameters (grain size, porosity, electrode thickness), enable the estimation of MIEC cathode performance. The complexity of a "real" cathode microstructure calls for the description by a finite element method (FEM), along with a high level of grid refinement. In a first step, the real microstructure is approximated in a representative volume element (RVE). Here a structure of spherical particles determined by a numerical sintering process is used as example. In a second step RVE's are discretized into voxels representing either (i) electrolyte or (ii) MIEC material or (iii) porosity. Finally, the FEM based model generates a spatially resolved 3-dimensional model of the cathode and calculates, among other parameters, the area specific resistance (ASRpol) as a figure of merit.