11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

Processing and Properties of Mixed Conductor Membranes for Oxygen Transport in Energy Systems

Detlev Stoever, Stefan Baumann, Michael Betz, Hans Peter Buchkremer, Wilhelm Albert Meulenberg, Falk Schulze-Küppers, Frank Tietz
Forschungszentrum Jülich, Germany
e-mail: d.stoever@fz-juelich.de

The use of oxygen conducting materials in energy conversion systems is of increasing importance considering enhancement of overall efficiency as well as CO2 systems and storage in the course of electricity generation. The special view of this contribution is on the use of oxygen conductors with mixed conductivity (not pure oxygen ionic conductivity) on one hand for highly efficient porous cathodes in SOFC's on the other hand for oxygen separation membranes in power plants using Oxyfuel technology. Advanced cathodes in SOFC's need highly mixed conductive materials e.g. perovskites of the composition type $La_{1-x}Sr\ Co_{1-y}Fe_yO_{3-\delta}$ in a well defined micro- or even nanostructural porous configuration enhancing the be oxygen exchange rates, for the electrochemical reactions enabling O^{2-} molecules to be ionised and penetrating the electrolyte. The manufacturing of the cathodes is being described thereby finding out the best compromise between obtainable microstructure for best oxygen/air transport, material composition as well as cost effective processing methods. Oxygen membranes for Oxyfuel type power plants are being developed because the technology used requires pure oxygen for combustion resulting in a higly pure CO_2 stream which could easily be sequestered. Also in this case $La_{1-x}Sr_xCo_{1-y}Fe_yO_{3-\delta}$ is a promising perovskite membrane material. However for this application gas tightness what means pore free, highly dense membranes are necessary. Moreover membrane thickness should be small enhancing the permeation flux. Additionally surface kinetics can be further accelerated by applying catalytic active layers on top of the permeation membrane. The processing of asymmetric multilayered membranes is being presented. Microstructural features as well as permeation data are given and further possibilities of new materials are discussed.