



Electroceramics XIII

June 24th - 27th, 2012

MESA+
INSTITUTE FOR NANOTECHNOLOGY

UNIVERSITY OF TWENTE.

Monday, June 25, 2012

Parallel session 2, location Waaier 2. Opening and plenary in Waaier 1.

	08.45	Opening by Dr. Anne Flierman, president University of Twente
		Chair: Gertjan Koster
Pl.1	09.00-09.45	Darrell Schlom (plenary) Changing Dielectrics into Ferroelectrics— Alchemy Enabled By Strain
Synthesis I		Chair: Pim Groen
O.10	10.00-10.20	Yanling Gao Low-temperature synthesis and characterization of ceramics driven from amorphous and nanocrystalline barium titanate powders
O.11	10.20-10.40	Jurij Koruza Microstructure Design of Sodium Niobate Ceramics
O.12	10.40-11.00	Hong-Yi Chang Blue light excited nanophosphors synthesized by soft wet methods
	11.00-11.30	Coffee break
Characterization I		Chair: Arturas Vailionis
I.3	11.30-12.00	Sara Bals Aberration corrected transmission electron microscopy for ceramic (multi)layers: advances and challenges
O.13	12.00-12.20	Armin Feldhoff Phase stability of oxygen-transporting ceramic membranes in the intermediate temperature range
O.14	12.20-12.40	Andris Sutka A route towards more sensitive ZnFe ₂ O ₄ gas sensors
O.15	12.40-13.00	Mara Bernardo Microstructure control in bulk Ti-doped BiFeO ₃ ceramics
	13.00-14.00	Lunch break
Characterization II		Chair: Roger De Souza
I.4	14.00-14.30	Dietrich Hesse Nanodomain vertex arrays in BiFeO ₃ single crystals
O.16	14.30-14.50	Tobias Klande Investigation of doped Ruddlesden-Popper La ₂ NiO ₄ and La ₄ Ni ₃ O ₁₀ phases as oxygen-transporting materials
O.17	14.50-15.10	Simon Kraschewski Characterization of grain boundaries in iron-doped SrTiO ₃ by analytical transmission electron microscopy
O.18	15.10-15.30	Andreas Pavitschitz Microstructural characterisation of ZnO varistor ceramics
	15.30-16.00	Coffee break
	16.00-18.00	Poster sessions
	19.00	BBQ

O.13	Phase stability of oxygen-transporting ceramic membranes in the intermediate temperature range <u>Armin Feldhoff</u> Institute of Physical Chemistry, Leibniz Universität Hannover, Germany, 30167
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The mixed conducting cubic perovskite $(\text{Ba}_{0.5}\text{Sr}_{0.5})(\text{Co}_{0.8}\text{Fe}_{0.2})\text{O}_{3-\delta}$ (denoted BSCF) is the state-of-the-art ceramic membrane material for oxygen separation technologies above 1150 K. In the intermediate temperature range (750 - 1100 K), however, BSCF suffers from a slow decomposition of the cubic perovskite into hexagonal perovskite and a modified 15R structure, which is accompanied by a degradation of oxygen transport. Temperature-dependent electron energy-loss spectroscopy (EELS) showed that, in the BSCF compound, redox stability of cobalt is remarkably lower than that of iron. At intermediate temperature, low-spin 3+ cobalt results, which has small ionic radius (54.5 pm) and is not tolerated by the cubic perovskite structure. After long-term oxygen permeation at intermediate temperature, BSCF membrane shows different occurrence of the aforementioned secondary phases at the oxygen feed side and the oxygen release side with respect to grain boundaries and grain volumes. Recently developed ferrites show improved phase stability at intermediate temperature as compared to BSCF, which can be understood by differences in redox stability (valence and spin-state) of cobalt and iron.

O.14	A route towards more sensitive ZnFe_2O_4 gas sensors <u>Andris Sutka</u> ¹ , Gundars Mezinskis ¹ , Andrejs Lūsis ² ¹ Institute of Silicate Materials, Riga Technical University, Riga, Latvia, LV-1048; ² Institute of Solid State Physics, University of Latvia, Riga, Latvia, LV-1063
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For enhancement of the sensitivity electron concentration in the n-type gas sensor material needs to be regulated in order to achieve equilibrium between optimal concentration of surface oxygen species and width of the depletion layer. The aim of the present work is to demonstrate that the sensing characteristics of a metal oxide semiconductor gas sensor using n-type zinc ferrite can be improved by controlling iron stoichiometry in composition.

The sol-gel auto-combustion has been used to produce nano-sized $\text{ZnFe}_{2+z}\text{O}_{4\pm\delta}$ materials. The sensors were characterized by using XRD, SEM and DC gas sensing measurements. To identify contribution of the depletion layer and grain interior, ac impedance spectroscopy (IS) measurements were performed.

XRD analysis reveals a pure cubic spinel type structure for zinc ferrite samples tested as gas sensors. SEM micrographs of the samples reveal microstructures with nanosized grains and open pores. No morphological differences were apparent between samples with various iron content. The complex impedance spectra shows a presence of two gas sensitive phases with different electric properties attributed to grain interior and depletion layer. Depletion layer of the grain gives higher signal due to higher influence of test gas to the electron concentration at the boundary layer. Overall, sensitivity by going from iron deficient to excess can be improved for the four times due to increase adsorbed oxygen states on grain surface. By reaching $z > 0,1$ sensitivity again drops due to remarkable decrease of depletion layer width, as concluded from IS analysis.

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