

Online Departmental Colloquium

Department of Materials Science
and Chemical Engineering



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Technion City, Haifa, Israel

**Investigation of thermo-chemical
expansions in doped ceria by a
novel temperature modulated
dilatometry approach**

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1:00 – 2:00 p.m.

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Investigation of thermo-chemical expansions in doped ceria by a novel temperature modulated dilatometry approach

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Abstract

Many metal oxides exhibit thermo-chemical expansion due to change in the chemical potential of oxygen. The latter can result in change of oxidation state of the metal ions and/or loss of oxygen upon temperature and PO₂ changes. These effects lead to mechanical failure in devices such as solid oxide fuel cells that operate at high temperatures and high PO₂ gradients. It is difficult to study thermal and chemical effects separately in a qualitative manner, as both effects occur simultaneously. In this talk, I shall discuss possible separation of the expansion caused by chemical effects from the pure thermal effects at different temperature ranges, using temperature modulated dilatometry. Such separation is possible if different processes occur on significantly different timescales. However, the case in our model materials - doped ceria and for comparison doped zirconia - is more complex, as different chemical effects are important at different temperatures. Values of coefficient of modulated temperature thermal expansion (MCTE) are compared with the coefficient of linear thermal expansion (CTE). The CTE remains independent of heating rate, whereas the MCTE generally depends on the modulation rate. The latter dependence of the MCTE is changed over temperature, as defect associates vanish, and cation valence change kicks in. This is a result of a very long and tedious work that in a retrospect I would not recommend to any grad student or postdoc to take upon him or herself. But hearing about somebody else's problems in a seminar might be interesting, though. At the second part of my talk, I will briefly describe the Stephen and Nancy Grand Technion Energy Program (GTEP).

Biosketch

Yoed Tsur received his PhD degree in Physics from the Technion in 1998, and then spent two years at Penn State University as a postdoctoral scholar in the Materials Research Lab. He has been awarded the Goldberg prize for energy research and Yanai citation from the Technion. Since 2000 he is a faculty member in the Chemical Engineering Department at the Technion. Prof. Tsur serves as the director of the Stephen and Nancy Grand Technion Energy Program (GTEP). This is a campus-wide multidisciplinary program that supports ambitious projects in various areas of energy research. GTEP concentrate on renewable energy research. In addition, Prof. Tsur is the head of a special program of ME in energy engineering with specialization in oil and gas. He serves on the editorial boards of Solid State Ionics and Journal of Ceramic Science and Technology. His research interests include synthesis and development of oxide materials for nanotechnology, point defect chemistry, electroceramics and electroceramic devices, impedance measurements and analysis, and energy research.