Gesellschaft Deutscher Chemiker
Ortsverband Hannover

Einladung zum GDCh-Colloquium des Ortsverbandes Hannover

Das Colloquium findet um 17h c.t. im Dr.-Oetker-HS (Raum 007, Geb.äude 2504) der Leibniz Universität Hannover, Institut für Physikalische Chemie und Elektrochemie, Callinstr. 3a, 30167 Hannover statt.

06.06.2024 **Prof. Dr. Armin Feldhoff,**
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200 years of the Carnot principle: Unified view of ceramic gas-transporting membranes and thermoelectric materials and recent performance improvements through texturing

The 1824 Carnot principle is one of the greatest achievements in physical sciences. It identifies entropy as the central operational quantity in any kind of heat engine. In its generalized form, the principle states that the fall of entropy down its thermodynamic potential, which is the absolute temperature, releases energy that can be transferred to a useful process. Thus, in addition to ionic and/or electric charge carriers, it is proposed to consider entropy as another fundamental quantity being transported through a thermo-ionic-electronic (TIE) material. Conversion of energy is easily understood as the loading of energy from entropy current (thermal energy) to ionic current or electronic current (both electrochemical energy). Analogies between the Soret coefficient, the Seebeck coefficient and the ionic transfer number become evident. The latter plays an important role in the context of the mixed ionic-electronic conductor (MIEC), which can be considered as TIE material under isothermal conditions. If the TIE material is simultaneously placed in gradients of temperature and electrochemical potential (ionic and/or electronic), currents of entropy, ionic charge carriers, and electronic charge carriers are observed (i.e. Soret diffusion or thermoelectrics). In the basic transport equation, the TIE material appears as tensor, which is a major advantage over the concept of the so-called thermodynamics of irreversible processes. The role of energy and its conversion is easily understood by the flux of entropy, ionic charge carriers, and electronic charge carriers at their respective local potentials, which are the temperature, the ionic electrochemical potential, and the electronic electrochemical potential.

An overview of the activities of our group in the context of the subsets of TIE materials, MIEC for oxygen-transporting membranes (OTMs) and thermoelectric (TE) materials is given with some emphasize on the utilization of anisotropic transport properties in layered oxide systems (e.g. $La_2NiO_{4+\delta}$, $Nd_2NiO_{4+\delta}$ and $Ca_3Co_4O_{9-\delta}$) in (nano)structured bulk ceramics with texture. Together with our cooperation partners, we have applied a variety of techniques for ceramic texturing, including electrospinning of nanofibers and nanoribbons, spark plasma sintering (SPS), spark plasma texturing (SPT), magnetic grain alignment, and crystal facet engineering via reverse microemulsion synthesis. Substantial performance improvements were realized.

Prof. Dr. Jens-Uwe Grabow
Vorsitz OV Hannover

Vor dem Colloquium findet ab ca. 16h30 eine ‚Kaffeerunde' mit dem Vortragenden in der Bibliothek des PCI statt.