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ENERGYPOLIS SEMINAR

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Regeneration of materials for a waste free future

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The prerequisite for electronic waste elimination is a durable active material with this the constant regeneration of the structure under e.g. electrical current, thermochemical and heating cooling cycles.
Electroceramics are indispensable materials for nearly all energy converters (1,2) and very often adopt the versatile perovskite structure.
Perovskite-type ceramics as well as their nanocomposites can be tuned to enable for multifunctional energy converters to reduce the use of critical materials. A good performance relies on their flexible crystal structure being able to accommodate defects during electrical, thermal and chemical redox processes. The design of a regenerative material is based on theoretical models and knowledge on composition-structure-property relationship. The perovskite structure allows diverse substitution reactions to tune the band structure, charge carrier density and mobility as well as thermal and ionic transport.
The electronic mobility can become high while the ionic and thermal conductivity can remain low. Strongly correlated electronic systems are employed as additional design elements for a targeted materials design (3).
Tailored soft chemistry synthesis methods result in nanostructured regenerative oxide materials as well as nitride and chalcogenite phases. These materials are characterized and tested in-situ for e.g. high temperature thermoelectric and catalytic applications to improve the efficiency and energy density of energy conversion devices.

References

(1) Saucke, G., Populoh, S., Thiel,P., Xie, W., Funahashi, R. and Weidenkaff, A., Journal of Applied Physics, 118, (2015) 035106.
(2) Thiel, P., et al, J. Phys. Chem. C 119(38) (2015) 21860-21867.
(3) Xiao, X., et al,, Phys.Chem.Chem.Phys., 19, (2017) 13469-13480.

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Anke Weidenkaff completed her PhD degree in Chemistry at ETH Zürich in 2000, received the Venia Legendi for Solid State Chemistry and Materials Science from the University of Augsburg in 2006 and became section head at Empa as well as associated professor at the University of Bern, Switzerland. Anke Weidenkaff is chair holder for Materials Chemistry at the University of Stuttgart since 2013. She published some 230 SCI rated publications on materials research in energy conversion technologies. She is director of the Institute for Materials Science at the University of Stuttgart, president of the European Thermoelectric Society (ETS), elected member of the MRS board of directors, the E-MRS Executive Committee and was co-chair of the E-MRS spring meeting in 2013. In 2011 she was awarded with the Kavli Foundation Lectureship prize.