AKE 5: Nanotechnologies for Energy Applications

Time: Monday 11:45–12:45 Location: A 151

AKE 5.1 Mon 11:45 A 151

Three-dimensional surface nanostructures for Energy Storage Applications — •Ranjith Vellacheri[1,2], Zhibing Zhan[1,2], Huaping Zhao[1,2], and Yong Lei[1,2] — [1]Fachgebiet 3D-Nanostrukturierung, Institut für Physik & Zentrum für Mikro- und Nanotechnologien (ZIK MacroNano), Technische Universität Ilmenau, 98693 Ilmenau, Germany — [2]Institut für MaterialPhysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

Development of inexpensive and high performance electrodes based on three-dimensional (3D) nanostructures (nanotube arrays) potentially useful for supercapacitor applications by adopting nano-porous templates assisted synthesis will be demonstrated here. The nano-porous templates we used to synthesize electrodes include highly ordered alumina and titania membranes. The deposition of MnO2 on well ordered and tailored templates and its modifications ease to fabricate regimented supercapacitor electrodes having immense surface area and superior ion diffusion properties for the enhanced charge storage along with high rate capability and cyclic stability. The improved energy storage properties of such 3D electrodes would be extremely useful for the development of light, compact and high performance supercapacitors for a variety of high power demanding stationary and portable applications.

AKE 5.2 Mon 12:00 A 151

Chemical Vapor Synthesis of Li7La3Zr2O12 as Solid-State Electrolyte for Batteries — •Ruzica Djenadic[1,2,3] and Horst Hahn[1,2,3] — [1]Joint Research Laboratory Nanomaterials - Technical University Darmstadt and Karlsruhe Institute of Technology, Germany — [2]Institute for Nanotechnology, Karlsruhe Institute of Technology, Germany — [3]Ulm Helmholtz Institute, Karlsruhe Institute of Technology, Germany

Present lithium ion battery technology is based on liquid organic electrolytes, which have several disadvantages related to their safety due to potential electronic short circuits of the electrodes, leakage of the liquid and additionally low energy densities. On the other hand, solid electrolytes are promising candidates to replace currently used liquid electrolytes as they are highly ionic conductive, chemically and electrochemically stabile. Recently, lithium ion conducting garnet-like oxides (e.g. Li7La3Zr2O12) has been seen as promising solid electrolytes for all-solid-state lithium ion rechargeable batteries. These oxides are usually synthesized using the conventional solid-state reactions or sol-gel method. Herein, we report the synthesis of Li7La3Zr2O12 using the chemical vapor synthesis. This is a non-equilibrium technique where precursors are homogenously mixed on the molecular level in the gas phase and nanoscaled powders of high purity, crystallinity and a narrow particle size distribution can be obtained.

AKE 5.3 Mon 12:15 A 151

Nanostructured thin film $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ synthesized via salt-assisted spray pyrolysis for micro-SOFC application — •Cahit Benel[1,2,3], Azad J. Darbandi[1,2,3], Anna Evans[4], René Tölke[4], and Horst Hahn[1,2] — [1]Institute for Nanotechnology, Karlsruhe Institute of Technology, Germany — [2]Joint Research Laboratory Nanomaterials/Technische Universität Darmstadt and Karlsruhe Institute of Technology, Germany — [3]Center for Functional Nanostructures, Karlsruhe Institute of Technology, Germany — [4]Nonmetallic Inorganic Materials, Department of Materials, ETH Zurich, Switzerland

Micro-solid oxide fuel cells (micro-SOFCs) are anticipated for battery replacement due to their increased energy capacity for applications such as portable electronic devices, mobile phones and laptops. In this work, nanocrystalline $La_{0.6}Sr_{0.4}CoO_{3-\delta}$ (LSC) powder with ultrafine microstructure and high specific surface area was synthesized via salt-assisted spray pyrolysis method. XRD results show the formation of a nanocrystalline single phase perovskite structure. Agglomerate-free LSC nanoparticles were stabilized in water-based dispersion without the need of ultrasonic energy application. Nanoparticulate cathode thin films of LSC with thickness between 150 and 500 nm were prepared via single step spin coating on yttria stabilized zirconia (YSZ) substrates. Gadolinium doped ceria (GDC) film was applied to YSZ substrate to avoid the chemical reaction between cathode and electrolyte. The performance of the thin film cathodes was evaluated by high temperature impedance spectroscopy on symmetrical samples.

AKE 5.4 Mon 12:30 A 151

Nanogenerator on the base of zinc oxide nanowires — •Farzaneh Fattahi Comjani[1], Julia Waltermann[1], Kay Michael Günther[2], Michael Köhring[1], Ulrike Willer[2], Stefan Kontermann[1], and Wolfgang Schade[1,2] — [1]Fraunhofer Heinrich Hertz Institut, Am Stollen 19B, Goslar, Germany — [2]Energie-Forschungszentrum Niedersachsen, Am Stollen 19B, Goslar, Germany

Nanogenerators on the base of piezoelectric nanowires is a new method for the transformation of mechanical energy into electric energy. Nanowires synthesized from materials with the wurtzite structure, such as ZnO, CdS and ZnS are piezoelectric and therefore the most important materials for nanogenerators. ZnO is also a semiconductor so that a nanogenerator on the base of ZnO nanowires is benefiting. The principle of ZnO nanogenerators is based on inducing a piezoelectrical potential in the nanowire by an external strength. In this work, we report a nanogenerator composed of vertical and dense ZnO nanowires, which are produced by a simple and economical wet chemical method directly on a glass substrate coated with silver. The capacity and electrical potential measurements show that the ZnO nanogenerator produces a piezocurrent if it is mechanical oscillated in microscopic scale.