Alexander Michaelis, J Material Sci Eng 2015, 4:4
http://dx.doi.org/10.4172/2169-0022.C1.024

OMICS International
conferenceseries.com

Alexander Michaelis
Fraunhofer Institute of Ceramic Technologies and Systems, Germany

Smart advanced ceramic materials for energy and environmental technology

Advanced ceramic materials offer enormous potential for innovations in the fields of efficient energy conversion and storage, propulsion systems, smart structures, sensor technology as well as environmental technology. The joint application of structural and functional ceramic technology allows for unique combination of electronic, ionic (electrochemical) and mechanical properties enabling the development of new, highly integrated systems in the above mentioned fields. However, due to the specific brittle failure mechanism of ceramic materials (Griffith behavior) the production of ceramic components requires new approaches for non-destructive in-line testing. This is illustrated with specific examples for smart systems development for fuel cells, batteries and ceramic membranes. As a first example, high temperature fuel cell systems' developments for both mobile and stationary applications are presented. In the power range from 1 W to several 10 kW, we use SOFC (Solid Oxide Fuel Cell) technology. For the high power range up to several MW, we prefer MCFC (Molten Carbonate Fuel Cell) technology. Both fuel cell types use conventional hydrocarbon fuels and are currently being commercialized. These fuel cells allow for ultra-high efficient power generation. In the combined heat and power (CHP) mode, efficiencies above 95% can be reached. Since the load following capability of fuel cells is limited, we also developed new ceramic based storage systems. These storage systems also can be used along with renewable power generation technologies (PV, wind) to solve the problem of base load feed-in. Examples for development of Li-ion batteries as well as high temperature NaNiCl batteries are presented. As an example for the potential of ceramic materials in the field of environmental technology, ceramic membranes are discussed. Such membranes can be used for micro, ultra or nano-filtration of liquids and gases. For this, a control and reduction of pore sizes below the 1 nm range is required.

Biography

Alexander Michaelis is the Director of Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Germany. He studied physics and received his Doctorate in the field of electrochemistry. In 1996 he accepted a position at Siemens AG working in the field of microelectronics amongst others at the DRAM Development Alliance in East Fishkill, New York. In 2000, he began to work for Bayer AG in Leverkusen changing subsequently to H.C. Starck GmbH, a Bayer subsidiary, where he was head of the Electroceramics and the New Business Development department. Furthermore, he was the Managing Director of InDEC B.V. working in the field of solid oxide fuel cells and finished his state Doctorate at University of Düsseldorf. Since 2004, he has been Director of the Fraunhofer Institute for Ceramic Technologies and Systems IKTS and has been holding the chair of Inorganic Nonmetallic Materials at TU Dresden. He has more than 40 patent families in materials science, microelectronics, and electronics and provided more than 100 publications. In 2012 he was awarded the ACerS Bridge Building Award for his contribution in the field of energy and environmental technology.

Alexander.Michaelis@ikts.fraunhofer.de

Notes: