

# Ceramic Electrolytes and Electrodes for All-Solid-State Batteries with High Energy and Power Density – Environmentally Benign, Inexpensive, Safe and Long Lasting

Werner J.F. Weppner  
Institute of Materials Science, Faculty of Engineering  
Christian-Albrechts University, Kiel, Germany  
ww@tf.uni-kiel.de

## **Abstract**

Solids can have a wide variety of structural and functional properties. In terms of electrical conductivity, they are used as metallic conductors, semiconductors or insulators. Ceramic materials can even show superconductivity at practically usable temperatures. In addition, ceramics are also able to transport ions. In many cases this conductivity is low, but in some cases it is very high and of practical importance due to structural disorder in the crystal lattice. As a result, solids can take on tasks that electrons are unable to perform. These are particularly important in the area of energy conversion and storage as well as environmental protection. In times of climate change and resource conservation, they are of outstanding practical importance. Applications include new generations of solid state batteries, fuel cells, electrochromic windows, and chemical sensors. In addition to ceramics with predominantly ionic conduction, such solids with mixed electronic-ionic conduction play an important role that has so far been neglected, e.g. for electrodes for rapid charging and discharging.

The possibilities of developing and using such ceramics with predominantly ionic conduction as well as mixed electronic-ionic conduction are shown in particular using the example of all-solid-state high-performance batteries. Applications in fuel cells and electrochromic systems are also briefly touched upon.

**Keywords:** *Ceramic Electrolytes and Electrodes, Batteries, Energy*

## **Short biography**

*Prof. Werner Weppner holds since 1993 the Chair for Sensors and Solid State Ionics at the Faculty of Engineering of Christian Albrechts University, Kiel, Germany. He has been earlier at the Max-Planck-Institute for Solid State Research, Stuttgart and a Research Professor at Stanford University, CA, USA, in the Department of Materials Science and Engineering. Prof. Weppner holds a diploma in physics from Mainz University and a Ph.D. in chemistry from Dortmund University, both Germany. His research interests are based on fast ionic transport in solids and include both fundamental understanding and practical application aspects*



IEECP'21, July 29-30, 2021, Silicon Valley, San Francisco, CA – USA

© 2021 IEECP – SCI-INDEX

DOI : <https://dx.doi.org/10.6084/m9.figshare.15048621>