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Semiconductor-ionic materials for new generation fuel cells

Currently two research fields are strongly correlated from semiconductor and ionic materials (SIMs), semiconductor physics and ionics, which have created "Three in one" electrolyte-free fuel cell technology and science. Semiconductor electronic band can induce ionic conducting properties and band structure changes resulting in superionic conduction. Strongly crosslink approaches from electrons and ions based on extensive experimental discoveries and evidences have made a strong indication for a promising research frontier and new generation fuel cell as the semiconductor-ionic devices, e.g. electrolyte (layer)-free fuel cell (EFFC) and single layer fuel cells (SLFCs). This is because the semiconductor-ionic materials can integrate fuel cell all anode, electrolyte and cathode functions into one component/layer thus to realize the fuel cell. We are working on both theoretical approaches and experiments to develop and establish a new discipline on Semiconductor-Ionics (Semionics) for energy applications. Using existing semiconductor physics and theories, materials, we extend into the ionic properties and energy band modifications by ion effect, e.g. correlation with ions, and electron-ionic correlated transport properties thus facilitating fuel conversions with higher efficiencies.

Biography

Bin Zhu obtained PhD in 1997 from Chalmers University of Technology, Sweden. He has made tremendous efforts and innovations on fuel cells and new energy conversion technologies over 20 years. He has invented and developed ceria-composite electrolytes for low temperature (300-600°C) solid oxide fuel cells (LTSOFCs), the electrolyte-free fuel cell and single layer fuel cells based on novel functional semiconductor-ionic materials (SIMs). He has established a large research network and led several research teams to explore SIMs for advanced energy applications covering fuel cell, solar cell and photocatalysts/electrolysis. He is Principal Investigator and Lead for establishing and developing semiconductor-ionics and new generation energy technologies. He is one of the Most Cited Researchers in China (Energy sector) for 2014, 2015 and 2016, reports published by Elsevier in 2015, 2016 and 2017.

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