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Advances in Materials for Energy Storage Science and Conversion †

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Abstract: In recent years, nanotechnology materials had considerable interest in worldwide researchers due to its interesting functional properties and applications in areas of energy, water, healthcare, and sensors technology. Research is being carried out worldwide to find alternative novel materials, improve the performance by various materials synthesis processes, surface modification, and fabrication technology. In my talk, I will discuss various studies on metal oxides, nitrides, fluorides, and graphene/metal oxide composite electrode materials related to electrochemical energy storage and conversion and other applications. Nanomaterials synthesis, characterization techniques, fundamentals, interface studies, and applications related to energy storage and conversion. Various preparation methods (Molten salt, Graphenothermal/carbothermal, coprecipitation, Hydrothermal, Combustion, Ball -milling, sol-gel and Nitridation, fluorination), Solid electrolytes sintering techniques by powder metallurgy techniques, and thin films fabrication and surface coating techniques. Prepared materials were characterized by Rietveld refinement X-ray diffraction, Neutron diffraction, Rutherford backscattering spectrometry (RBS), Nuclear reaction (NRA), AES, X-ray absorption/photoelectron spectroscopy (XAS/XPS), SEM, TEM, Raman/IR, density, and BET surface area methods. Electrode fabrication and various electroanalytical studies like cyclic voltammetry, galvanostatic cycling, and electrochemical impedance spectroscopy, GITT, PITT techniques for Li,Na,K -ion batteries, and in situ and ex situ studies, reaction mechanisms, and voltage hysteresis and present challenges will be discussed. Finally, I will briefly discuss materials recovery techniques and a few other interests related to Supercapacitors, Organic cathodes, Solar cells, metal-air batteries, Electrocatalysis, photocatalysis, and future directions.

Keywords: electrochemical science; nanotechnology; application; materials synthesis; energy storage & conversion; characterization and applications.

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Conflicts of Interest

The authors declare no conflict of interest.