CHARACTERIZATION OF HIGH PERFORMANCE ELECTROCHEMICAL SYSTEMS FOR PORTABLE POWER

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ABSTRACT

The long-term objective of the research has been to perform the enabling materials research necessary for the development of a battery oriented to the consumer market with special requirements in terms of safety, cycling life, and high specific energy and power. We have discovered novel processing of V₂O₅ gels that leads to aerogel (ARG) and xerogel (XRG) films with specific energy and Li insertion capacity that are much higher than for other amorphous or crystalline forms of V₂O₅. We have also found that the new materials will host Mg²⁺ and other cations which should be the basis for novel high energy, high power consumer battery systems. The investigation has examined (1) how temperature synthesis of V₂O₅ aerogel host materials, (2) characterization of insertion of Mg²⁺, Zn²⁺, and Al³⁺ into the V₂O₅ hosts, (3) anode materials for the new systems, and alternate anode materials to replace the intrinsically unsafe lithium metal for lithium batteries, and (4) the feasibility of safer, nonaqueous, high performance battery design.