DOE/ER/14384-1

FINAL REPORT

**CHARACTERIZATION OF HIGH
PERFORMANCE ELECTROCHEMICAL
SYSTEMS FOR PORTABLE POWER**

Final Report
for Period September 15, 1993 - December 31, 2001

W.H. Smyrl and B.B. Owens

University of Minnesota
Minneapolis, MN 55455

September 2002 DOE Patent Clearance Granted

Mark P. Dvorscak Jan 29, 2003
Date
Mark P. Dvorscak
(630) 252-2393
E-mail: mark.dvorscak@ch.doe.gov
Office of Intellectual Property Law
DOE Chicago Operations Office

Prepared for

THE U.S. DEPARTMENT OF ENERGY
AWARD NO. DE-FG02-93ER14384

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

CHARACTERIZATION OF HIGH PERFORMANCE ELECTROCHEMICAL SYSTEMS FOR PORTABLE POWER

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed or represents that its use would not infringe privately-owned rights.

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 V_2O_5 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 V_2O_5 . We have also found that the new materials will host Mg^{+2} 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 V_2O_5 aerogel host materials, (2) characterization of insertion of Mg^{+2} , Zn^{+2} , and Al^{+3} into the V_2O_5 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.