hydrate. Test results will reveal the form of the spilled hydrate and the extent of the downwind danger zone in which chlorine vapor concentrations are capable of producing injuries. Other work scheduled for the last quarter of 1979 are additional vapor dispersal calculations and a preliminary assessment of the insurance implications of the chlorine hazard.

Since commercial battery and vehicle configurations remain to be prescribed, it is anticipated that the results of this study will form the basis of future iterative hazard assessments as opposed to an absolute estimate of the casualties expected with widespread use of zinc–chlorine electric vehicle batteries. For example, the study will provide a means for quantitatively determining the benefits to be derived by incorporating additional safety features into the battery design, but absolute casualty levels will still depend upon how the electric vehicles are used and misused, and, *a priori*, are extremely difficult confidently to predict.

STUDIES OF HIGH ENERGY CATHODES AND ANODES FOR MOLTEN SALT BATTERIES

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This program deals with research and development of a new rechargeable cell

SCl_3^+ in $AlCl_3$–NaCl/Na^+ ion conductor/Na.

This cell operates at temperatures in the range 180 - 250 °C and has an open circuit voltage of 4.2 V. The research during this period has involved additional electrochemical, spectroelectrochemical, and spectroscopic (Raman and electron spin resonance) studies of sulfur and its oxidation products in chloroaluminate melts.

Laboratory cell development has involved studies with three Na^+ ion conductors: β''-alumina, β-alumina (from NGK) and NASICON. Only the first material was found to be satisfactory in this cell. One of the cells studied underwent 47 deep discharge/charge cycles at current densities of 10 - 50 mA/cm^2 before it failed due to a crack in the β''-alumina tube. The performance of a cell prepared in the discharged state (elemental sulfur in equimolar $AlCl_3$–NaCl) was found to be the same as that of a cell prepared in the charged state (SCl_3AlCl_4 in an $AlCl_3$-rich melt).

Recent publications

1 G. Mamantov, V. E. Norvell and L. Klatt, Spectroelectrochemistry in melts: applications to molten chloroaluminates, *Ext. Abstr. No. 357, Volume 78-2, Fall Meeting Electrochem. Soc., Pittsburgh, PA, October 15 - 20, 1978.*
2 R. Huglen, F. W. Poulsen, G. Mamantov, R. Marassi and G. M. Begun, Raman spectral studies of elemental sulfur in Al_2Cl_6 and chloroaluminate melts, *Inorg. Nucl. Chem. Lett., 14* (1978) 167.
3 R. Marassi, G. Mamantov, M. Matsunaga, S. E. Springer and J. P. Wiaux, Electrooxidation of sulfur in molten $AlCl_3$–NaCl (63 - 37 mole%), *J. Electrochem. Soc., 126* (1979) 231.
4 G. Mamantov, R. Marassi, F. W. Poulsen, S. E. Springer, J. P. Wiaux, R. Huglen and N. R. Smyrl, SCl_3AlCl_4: Improved synthesis and characterization, *J. Inorg. Nucl. Chem., 41* (1979) 260.

PERFORMANCE CHARACTERIZATION OF A SOLID STATE STORAGE BATTERY SYSTEM

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Totally solid state lithium batteries have been produced for several years for extremely long-life, low rate, ambient temperature applications. Since no liquid is present, there is no leakage, no self-discharge, and no corrosion. Also, individual cell containers are not needed, since the solid cells may be stacked one on top of the other. This frees valuable space for the active components and results in increased packaging efficiency. No sintering of the LiI(Al_2O_3) solid electrolyte is necessary, since it can be densified simply by pressing. It was recently discovered that this electrolyte can be made highly conductive and stable towards lithium at 300 °C, opening up the possibility of making high rate, totally solid, rechargeable cells of the type Li intermetallic/LiI (Al_2O_3)/solid cathode. Preliminary tests confirmed that the development of such cells was feasible, and calculations showed that cost-competitive batteries having energy densities and sustained power densities of 200 W h/kg and 70 W/kg, respectively, could ultimately be developed. The intent of the present program is to define and investigate as far as possible the scientific and engineering problems that will be encountered during such development and to increase cell performance to the point that batteries can be made.

The program thus far has concentrated on making small (0.6 in. dia., 100 mA h) cells containing various cathode compositions and cycling them between 1 V and 3 V at 5 mA/cm^2 and 300 °C. Substantial progress has been