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ADVANCED RECHARGEABLE SODIUM BATTERIES WITH NOVEL CATHODES

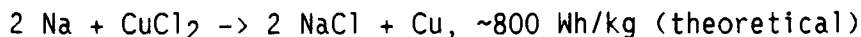
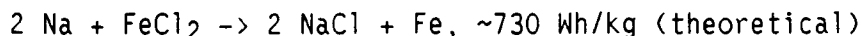
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Various high energy density rechargeable batteries are being considered for future space applications. Of these, the sodium-sulfur battery is one of the leading candidates. The primary advantage is the high energy density (760 Wh/kg theoretical). Energy densities in excess of 180 Wh/kg were realized in practical batteries. Other technological advantages include its chemical simplicity, absence of self-discharge, and long cycle life possibility.

More recently, other high temperature sodium batteries have come into the spotlight. These systems can be described as follows:

Na/ $\beta$ -Al<sub>2</sub>O<sub>3</sub>/NaAlCl<sub>4</sub>/Metal Dichloride

Sodium/metal dichloride systems are colloquially known as the zebra system and are currently being developed for traction and load leveling applications. The sodium-metal dichloride systems appear to offer many of the same advantages of the Na/S system, especially in terms of energy density and chemical simplicity, e.g.,



These metal dichloride systems offer increased safety and good resistance to overcharge and operate over a wide range of temperatures from 150-400°C with less corrosion problems.

We at JPL are evaluating various new cathode materials for use in high energy density sodium batteries for advanced space applications. Our approach is to carry out basic electrochemical studies of these materials in a sodium cell configuration in order to understand their fundamental behaviors. Thus far, our studies have focused on alternate metal chlorides such as CuCl<sub>2</sub> and organic cathode materials such as TCNE. The preliminary findings of our studies will be presented.