METAL AIR FUEL CELLS ON MARS
(Poster)

Wesley Bruce
Wesleybruce@iinet.net.au

Metal air batteries or metal fuel cells have ten times the energy density of many current batteries somewhat greater energy density than some of the lithium batteries used today on Mars.

Evonyx, has a zinc air battery that holds the record for a battery powered electric vehicle run. It has an estimated 600 mile range on a Honda Insight and a proven range of 214 miles; top speed of 72mph (115km/hr). The battery was a MetFuel™ (high energy density zinc-based fuel). This company is working on a defence contracts for aluminium Fuel cells in the 500 Wh/kg and 750 Wh/kg and alkaline fuel cell in the 1000Whr/kg with a total energy capacity of 1.4kWh. See web link at http://www.evionyx.com/home.htm,

Another company is developing an Aluminium air battery with a similar properties and performance. See: http://www.europositron.com/en/index.html
This company is less advanced but claims an energy density of 1330 Wh/kg. The patents of these two companies may clash a little.

Metal air cells are not new. They have been known for many decades but dendrite growth, little metal whiskers in the electrolyte, degrade the cell quickly. The solution is nanopor membranes or dry electrolyte systems in contact with the metal. These prevent dendrite growth allowing the higher power of metal air cells to be used and leading to very long charge/discharge endurance.

The other catch is that these are air breathing cells; they oxidize the metals to generate power. Thus they are true fuel cells not simple batteries. On earth that's not a problem and these technologies will take off, in an era of $60 a barrel for oil, and make big inroads into the automotive field. Yet in space and on Mars hauling around the extra weight of oxygen may be a major problem. As we charge the cells we must store the oxygen liberated and as we draw the power we must provide the oxygen back to the cell.

This wont be a problem at a base. There are more applications for hydrogen than oxygen so a surplus of oxygen is probable. The technology designed to generate oxidiser for the return stage craft could run for a few additional days or months provisioning the base with additional oxygen for metal fuel cell operation. On an exploration rover or robot explorer the need to add an oxygen tank and compressor may be the difference between the technology being useful or not. It may be viable today, I can't find precise data on the mass of the Mars Explorer batteries. If our oxygen tankage options improve with new materials the technology could quickly become viable.

We need to consider the technology and keep it in focus. If the energy density keeps rising then we have an opportunity for applications in the bases themselves and eventually the vehicles and robots.

NOTES