EXTENDED ABSTRACTS

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Extended Abstracts
of
BATTERY DIVISION

Subjects:

Characteristics of Fuel Cell and Battery Electrodes

Lithium Battery

Rechargeable Alkaline Zinc Electrodes

General Session

*Molten Carbopnate Fuel Cell Technology

**Energy Storage for Solar Applications

*Sponsored jointly with Battery/Corrosion/Electrothermics and Metallurgy/Energy Technology

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GENERAL SESSION

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Abstract No. 1

FUEL CELL AND BATTERY ELECTRODES

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Battery and fuel cell electrode development has undergone intensive effort in the past two decades.

In the nickel cadmium area, we have seen a pursuit of high reliability result in more controlled structures and impregnation techniques and consequently higher cycle life. For the lead acid battery, studies of grid contouring and paste formation are leading to longer life, lighter weight structures.

More advanced, near-term secondary batteries stressing high energy densities such as nickel-zinc and nickel-iron have seen the development of entirely new forms of nickel electrodes wherein the conventional high cost sintered nickel plaque has been abandoned in favor of either polytetrafluoroethylene (PTFE)-graphite or nickel plated steel wire structures. Zinc and iron electrode technology have both seen substantial improvements.

Long-term, high energy secondary battery programs have led to whole new electrode technologies for such diverse battery systems as zinc-chlorine, lithium-iron sulfide and sodium-sulfur. These new approaches to batteries are at a rudimentary stage. In some cases the chemistry of side, reverse and overcharge electrode reactions are still not well understood. One can expect the battery cycling characteristics of the new systems to be affected by the chronic problems of structure rearrangement.

Fuel cell electrodes have undergone a virtual explosion of research and development in recent times. Beginning with the space program of the sixties and followed by the energy related problems of the seventies, we have seen a truly substantial improvement in fuel cell electrode technology.

From the pure platinum black structures of the sixties to the mixed precious metal catalysts of the early seventies to the carbon and graphite supported catalysts of the present, the yield of power per unit weight of catalyst has increased several fold. The PTFE-catalyst structure for producing a gas-liquid-solid interface has shown that electrochemical reaction rates may someday approach those of direct combustion.

Equally promising has been the recent progress made on electrodes for molten salt "second generation" fuel cells. In this case, nickel alloy electrodes have been shown to be stable for long periods of time and the G-L-S interface is maintained by cleverly balancing electrode-electrolyte matrix pore size distribution.

Hybrid fuel cell-battery electrochemical cells such as metal-air and metal oxide-hydrogen cells have also resulted in some unique electrode configurations in recent years.

In general, the progress made in electrochemical electrode technology could open doors to more efficient, energy saving, electric power generation and transportation systems. Further the experience gained in developing improved fuel cell and battery electrodes may have fall out in electro-organic synthesis and certain metal and chemical electrowinning industries.