

## Alkaline Fuel Cells

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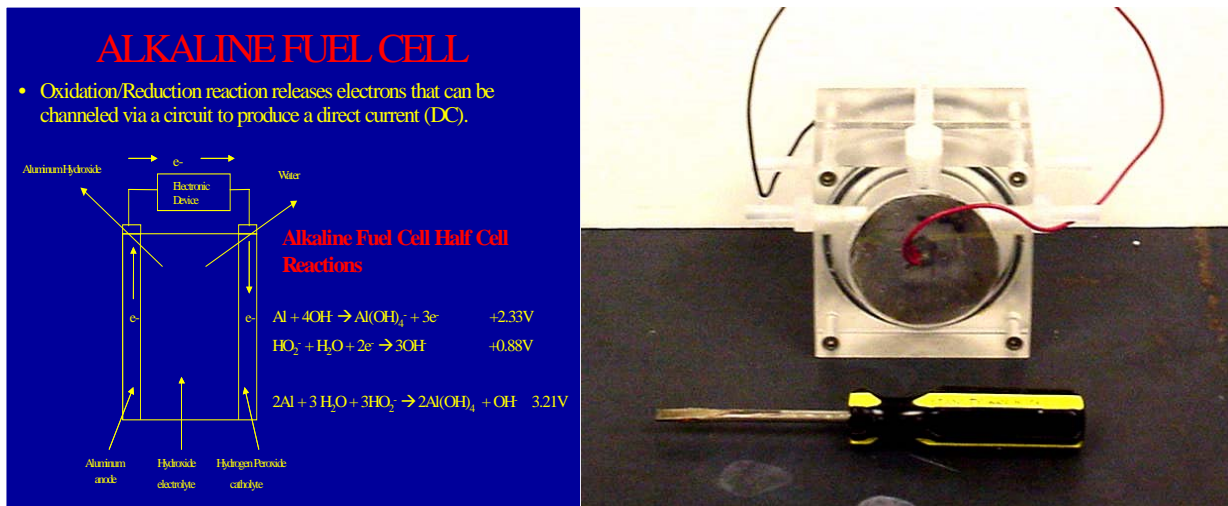
**Project Objectives:** The objective of this research is to demonstrate a functioning alkaline fuel cell based on nanoparticles of metals.

**Approach:** Alkaline fuel cells use a metal, such as aluminum, as their source of energy. Most fuel cells rely on hydrogen as the fuel. The major problem with hydrogen is our inability to store it cost-effectively and safely, and difficulty in generating hydrogen on-site from conventional carbon-based fuels, such as oil, natural gas, or coal. In addition, carbon-based fuels emit carbon dioxide, which has been implicated as an earth warming gas. Alkaline fuel cells offer the advantages of use of a metal, such as aluminum, as the fuel source, and generates no carbon dioxide, can operate at room or higher temperature, the metal oxide formed is environmentally benign, aluminum is a common metal present in most soils around the world, and aluminum-air fuel cells can extend the range of an electric van from 75 km using lead-acid batteries to 300 km. These fuel cells are over seven times more energy dense by weight and occupy less than one-seventh of the space of commercial lead-acid batteries.

Recent experiment has shown that aluminum fuel cells (Fig. 7) are capable of generating sustained power, using nanoparticles of aluminum to increase surface area and overall conversion of the metal to electrical power.

Specifically, the proposed objectives of the proposed research are:

- Develop a test cell using nanoparticles of various metals and metal alloys, such as aluminum, zinc, copper, iron and calcium.
- Experimentally obtain the power density for various particle sizes;
- Operate the cell at both low and high temperatures; and
- Develop a reliable metal particle slurry injection system for the cell.



**Fig. 7.** Schematic and photograph of an alkaline fuel cell using aluminum as fuel source.