

Metal-Air Batteries

PROJECT DESCRIPTION

There is a push from governments to lower greenhouse gas emissions and to improve air quality through the use of alternative energy sources, such as solar and wind power. High efficiency electrical energy storage (EES) devices are a key component in reaching these goals. These devices are able to store chemical or physical energy that can be later converted back to electricity. Zinc-air batteries (ZABs) are one of the best candidates to store large amounts of electricity. ZABs use oxygen in the atmosphere as the cathode reactant in the discharge process. Oxygen diffuses into the cell and is reduced to OH⁻ in the presence of a catalyst at the air cathode (oxygen reduction reaction or ORR). At the same time, the zinc anode is oxidized and dissolves in the electrolyte, producing zincate ions. During recharging, zinc metal is reduced from zincate ions and plated at the zinc anode. Oxygen is generated at the air cathode through the oxygen evolution reaction (OER).

The efficiency of ZABs is comparatively low, due to the sluggish ORR and OER kinetics at the air electrode. In addition, electrode stability is poor because the catalyst can peel off or pulverize and/or the substrate (usually carbon-based) containing the catalyst can corrode/deteriorate during battery cycling. The key to increasing efficiency and stability is to properly combine a bifunctional catalyst with a suitable battery electrode to catalyze both ORR and OER. This work will focus on developing improved air electrodes, both the substrate and catalyst, to enable high energy densities over many battery cycles.

Ultimately, the batteries developed in this work will be used to store energy generated from alternative, intermittent energy sources.

FACULTY-DEPARTMENT

Engineering - Chemical and Materials Engineering

DESIRED FIELD OF (STUDENT) STUDY

Materials science and/or engineering

INTERNSHIP LOCATION

University of Alberta Main Campus - Edmonton

NUMBER OF INTERNSHIP POSITIONS

1

INTERNSHIP START DATE

July 3, 2018

INTERNSHIP END DATE

October 3, 2018

ARE THE DATES FLEXIBLE?

Yes, I am flexible regarding the internship dates. Selected students can contact me to request a date change.