

Marian University, Indianapolis

Assignment 4 - Batteries and Fuel Cells

The usual strategies apply:

Use all literature available (including Wikipedia), but apply proper research methods to verify information, and refer to sources appropriately. Note that the IGSS WIKI links page contains some useful starting points.

Divide labor, then one person will collect data before end of IGSS and write a report.

Include calculations where appropriate.

Discuss your results amongst yourselves, and post results (“mini-reports”) to your page on IGSS Wiki.

The Mackay book does not contain much material on these topics, but there are a few references to batteries and fuel cells in the *Index*.

Topics (example):

1. Efficiency can be defined in various ways, but from the point of view of “exergy” it can be defined in terms of the fraction of the Gibbs free energy that can be converted into electrical work. Survey some battery types (*i.e.* redox systems), and calculate  $\Delta G^0$  for the relevant reactions (using *activities* if you know how). How do the conditions in the battery differ from standard conditions? How does this affect  $\Delta G$ ?
2. For the same redox systems, survey the literature and obtain nominal efficiency values. Compile a table of these values. Which systems are best and worst? Is there a range of values? Does efficiency correlate at all with the number of discharge/recharge cycles a battery can tolerate?
3. Survey current “nanoarchitecture” strategies for improving electrode efficiency. Pick out and discuss a couple of interesting examples.