

LEAD-ACID BATTERY

Lead-acid batteries, invented in 1859 by the Irish physicist Gaston Plante, are a type of galvanic battery and are the most commonly used batteries today.

Uses

They are used extensively as a back up power supply for computers and other creatures where this back up is essential. In these computers, a large number of cells are used to make up the full voltage requirement.

Also the modern [Segway scooters] uses a lead-acid battery for power supply.

They are also used in vehicles such as scooters, in which the low energy-to-weight ratio may in fact be considered a benefit since the battery can be used as a counterweight.

Construction

Lead-acid car batteries consist of six cells of 2.1 V nominal voltage. Each cell contains (in the charged state) electrodes of lead metal (Pb) and lead (IV) oxide (PbO₂) in an electrolyte of about 37 % w/w sulfuric acid (H₂SO₄). Modern designs have gelled electrolytes. In the discharged state both electrodes turn into lead(II) sulfate and the electrolyte turns into water. (This is why discharged lead-acid batteries can freeze).

Care

Lead acid batteries for automotive use are not designed for deep discharge and should always be kept at maximum charge, using constant voltage at 13.8 V (for six element car batteries). Their capacity will severely suffer from deep cycling, due to sulfation, or hardening of the lead sulfate. Specially designed deep-cycle cells are much less susceptible to this problem, and are required for applications where the batteries are regularly discharged.

A chemical compound in the form of tablets can be added to each cell to reduce sulfate build up, and improve battery condition, however the effectiveness of such treatments is subject to debate.

Specification

The following are common for lead-acid batteries:

Quiescent(open-circuit) voltage at full charge: 12.6 V

Unloading-end: 11.8 V

Charge with 13.2-14.4 V

Gassing voltage: 14.4 V

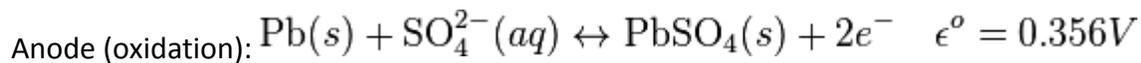
Continuous-preservation charge with max. 13.2 V

After full charge the terminal voltage will drop quickly to 13.2 V and then slowly to 12.6 V.

The energy to weight ratio, or specific energy, is in the range of 108 kJ/kg (30 Wh/kg).

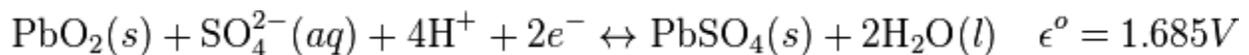
Chemical reactions

The chemical reactions are (charged to discharged):



Cathode

(reduction):



Because of the open cells with liquid electrolyte in most lead-acid batteries, overcharging with excessive charging voltages will generate oxygen and hydrogen gas, forming an extremely explosive mix. This should be avoided. Caution must also be observed because of the extremely corrosive nature of sulfuric acid.

Environmental Concerns

Currently attempts are being made to develop alternatives to the lead/acid battery (particularly for automotive use) because of concerns about the environmental consequences of improper disposal of old batteries

Other applications

Wet cells designed for deep discharge are commonly used in golf carts and other battery electric vehicles, large backup power supplies for telephone and computer centers and off-grid household electric power systems.

Gel cells are used in back-up power supplies for alarm and smaller computer systems (particularly in Uninterruptible_power_supply systems), and for electric scooters and electrified bicycles and marine applications. Unlike wet cells, gel cells are sealed, so they are less prone to spilling and do not require maintenance of electrolyte levels.

Absorbed glass mat (AGM) cells are also sealed, and used in battery electric vehicles.

Historically Lead Acid batteries were used to supply the filament (heater) voltage (usually between 2 and 12 volts with 6v being most common) in vacuum tube (valve) radio receivers in areas where there was no mains electricity supply available. Such radios usually used two (sometimes three) batteries a "wet" (Lead/Acid) "A" battery for the filament voltage and a higher voltage (45v-120v) "dry" non-rechargeable "B" battery for the plate (Anode) voltage. A few sets also used a third "C" dry battery (usually 2 volts) for grid bias.

Source : http://engineering.wikia.com/wiki/Lead-acid_battery