Secondary battery (Lead storage battery)

Batteries/cell

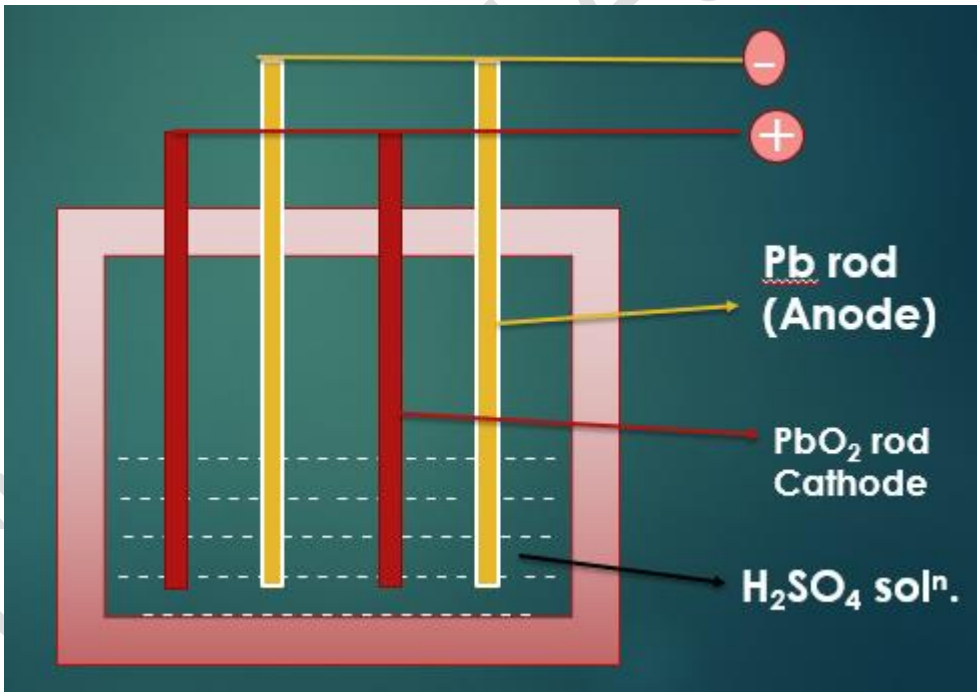
An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smart phone and electric cars.

Secondary battery - It can be charged & discharged again and again. Therefore, it is also called rechargeable battery. They can have their chemical reactions reversed by applying electric current to the cell

Types of batteries

Batteries are classified into three main types

1. Primary battery – It cannot be charged once it is discharged.
2. Secondary battery - It can be charged & discharged again and again. Therefore, it is called rechargeable battery.
3. Reserve battery - By a special arrangement, such battery is designed for long storage before use.



Construction and working of lead storage battery

In lead storage battery six cells are connected in a series. Lead storage battery consists of Porous lead (Pb)as anode connected to negative terminal of the battery and Lead-dioxide (PbO_2) as a Cathode connected to the positive terminal of battery.

Sulfuric acid (H_2SO_4) solution is used as an Electrolyte solution in the battery.

The two types of reactions take place in battery i.e. charging and discharging.

While discharging, chemical energy is converted into electrical energy and the lead at the *anode* is oxidized to Pb^{2+}

At (+) electrode: $PbO_2(s) + 4H^+(aq) + SO_4^{2-}(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O(l)$

At (-) electrode: $Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$

*T*he lead storage cell can be *recharged* by passing a current in the reverse direction. The half-reactions are the exact reverse of those that occur when the cell is operating as a voltaic cell.

While charging, electrical energy is converted into chemical energy and the Pb^{2+} is reduced at the cathode as Pb.

At (+) electrode: $PbSO_4(s) + 2H_2O(l) \rightarrow PbO_2(s) + 4H^+(aq) + SO_4^{2-}(aq) + 2e^-$

At (-) electrode: $PbSO_4(s) + 2e^- \rightarrow Pb(s) + SO_4^{2-}(aq)$

The overall reaction is

$Pb(s) + PbO_2(s) + 4H^+(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2H_2O(l)$

Advantages of Lead storage battery:

1. Batteries available in of all shapes and sizes
2. It is Maintenance-free
3. Best value for power and energy per kilowatt-hour
4. Have the longest life cycle and a large environmental advantage
5. The lead is recycled and reused in new batteries

Disadvantages of Lead storage battery:

1. Lead is heavier compared to alternative elements
2. Certain efficiencies in current conductors