Nickel Cadmium Battery

Parts: See Figure 5

- Advantages:
- High Current Output
- Tolerant to overcharging
- Cost

Disadvantages: • Cadmium is not eco friendly • High Memory Effect





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Figure 5 cap vent ball cover seal positive tab core separators can pressed powdered , negative electrode "jelly roll' insulating washer sintered positive electrode

Nickel Metal Hydride Battery

Difference from NiCd: Uses Metal Hydrides as Cathode instead of cadmium

- Advantages:
- Higher Capacity
- Lower Memory Effect
- Eco Friendly
- Disadvantages: • Slow Charging
- Discharge current is lower
- Self-Discharging
- Lower Capacity



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Electrochemistry and its Applications on Batteries



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ELECTROCHEMISTRY = Study of chemical processes that cause electrons to move.

REDOX Reactions = Chemical Reactions that consume or produce free electrons in a system. A REDOX Reaction can be seen as one molecule donating an electron to another molecule. Since this electron must move from one molecule to the other, the electron must travel a certain distance, which we can observe as electricity. (See Figure 1)

Electricity comes from electrons moving (dynamically) in a system, either in a direct way or alternating way. It is in the name ELECTRicity.

What is a Battery? A battery is a Galvanic Cell (Voltaic Cell), designed in different ways and with different materials for the components and reactions. Batteries derive their names from their material components.

Parts of a Galvanic Cell:

- Anode Oxidation or donation of electrons
- Cathode Reduction or consumption of electrons
- Electrolyte Proton and ion transferer
- Separator Wall which isolates the anode from the cathode Current Collector – Wire which transfers electrons from one side to the other

Lithium-Ion Battery

Parts: See Figure 2

Advantages:

- Low Maintenance
- High Cell Voltage
- Self-Discharging
- Protection Required Cost Transportation Shipping

Disadvantages:

and Handling Limitations)



LiPo - Change from Li-ion: Polymer electrolyte instead of regular () liquid electrolyte

Advantages:

- · Lack of the Memory Effect (Memory Effect is the process of which recurring charge and discharge results in lower capacity)
- Low Discharge Rate Sizes Safe
- Disadvantages:
- Overheating Fragile
- Transportation Cost

Disadvantages:

Energy Density

Low Capacity

LMO - Change from Li-ion: Magnesium Oxides used in the cathode

Advantages:

- High Temperature Stability Safety
- High-Rate Capability
- Low Internal Resistance

NCA = Change from Li-ion: Nickel Cobalt Aluminum oxide blends used in Cathode

Advantages:

- High Voltage
- Fast Charging Capability

Disadvantages:

· Low cobalt and nickel resources lead to higher costs

NMC = Change from Li-ion: Nickel Manganese Cobalt Oxides used in cathode

Advantages:

- NMC cathodes contain the most
- Longer Life Cycles Lower Cost energy amount by weight and volume

Disadvantages:

- Mechanical Instability (Possible mechanical failures)
- Lower Voltage than NCA

LFP = Change from Li-ion: Iron Phosphate used in cathode

Advantages: Durability

Long Life cycles

- High self-discharge
- LTO = Change from Li-ion: Titanium Oxides used in Anode

Advantages:

- Good discharge in low
- temperatures (high efficiency) • Long Lifetime (shelf-life)
- · Fast Charge capability in wide temp range
- · Safest amongst Li-ion Batteries

Alkaline Batterv

Parts: See Figure 3

- Advantages:
- Low temp resistance and efficient in low temp
- High shelf life
- Low Cost
- No Travel restrictions

Disadvantages:

- Bulky
- Safety
- · Leakage of a corrosive
- liquid (potassium hydroxide) that damages devices they are in
- High Internal Resistances





- Not environmentally friendly
 - Transportation Restrictions

- I ow cost
 - Excellent Safety

Disadvantages:

Low Nominal Voltage

Disadvantages:

High cost

· Low voltage and energy density

- Disadvantages: Heavy and bulky
- Charged Slowly