

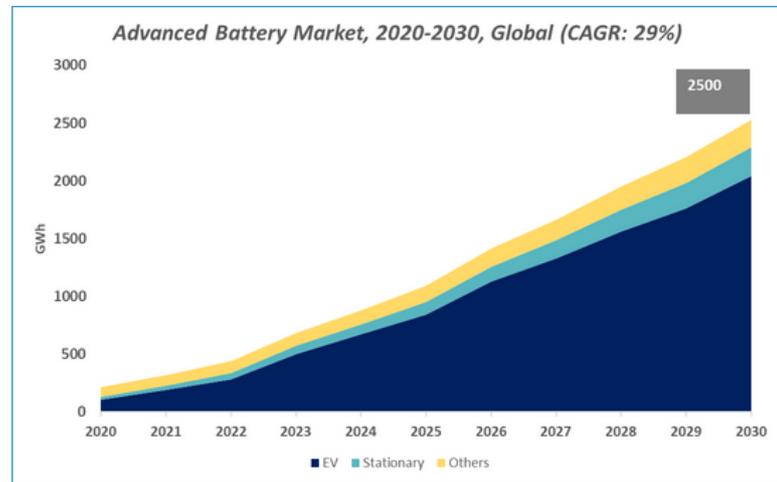
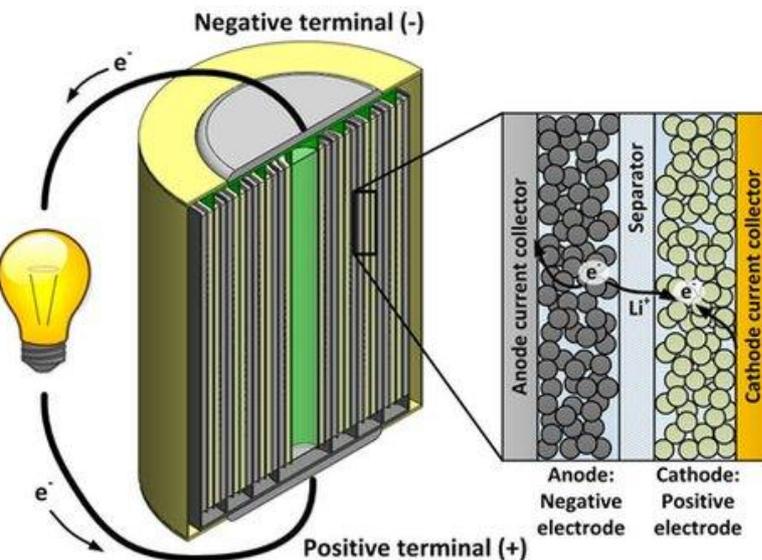
# LI-ION BATTERIES THE FUTURE OF WORLD



A White Paper Prepared By Ross Process Solution India Pvt Ltd, Pune, India



# Li-ion Batteries the Future of World



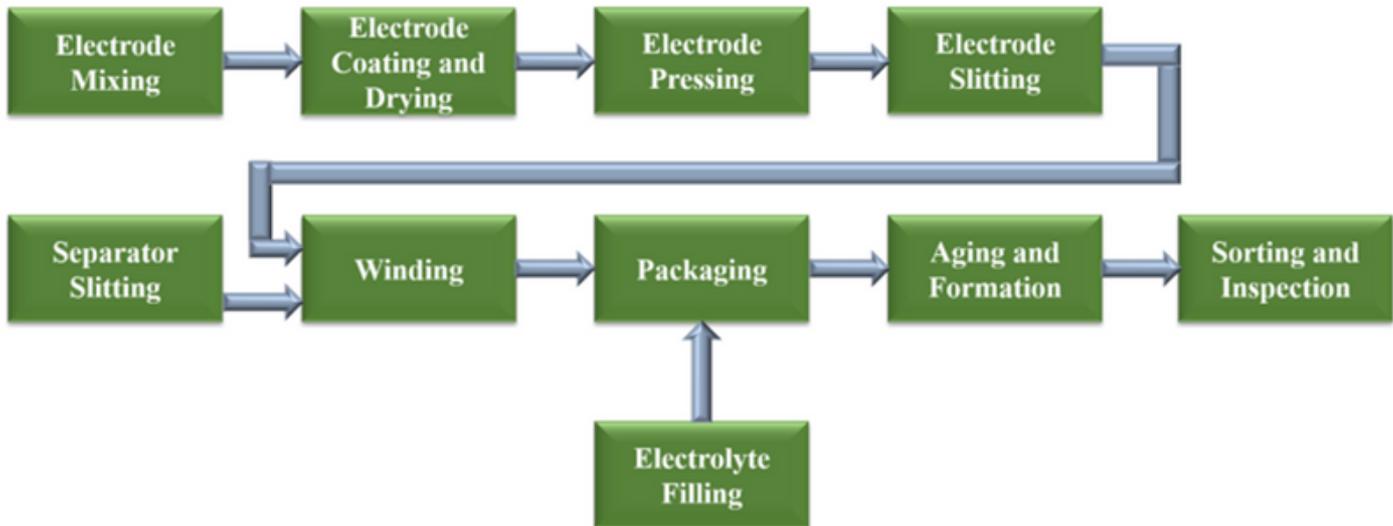
## Introduction:

Since their inception in 1991, lithium-ion batteries (LIBs) have emerged as a sophisticated energy storage formulation suitable for applications such as cellular phones, laptop computers, and handheld power tools. Recently, LIBs have received widespread acceptance as the most suitable power source for many alternative fuel vehicles, including fully electric battery electric vehicles, that could play a meaningful role in combatting anthropogenic climate change.

## Advantages of Li-ion batteries compared to other batteries:

Compared to the other high-quality rechargeable battery technologies (nickel-cadmium or nickel-metal-hydride), Li-ion batteries have a number of advantages. They have one of the highest energy densities of any battery technology today (100-265 Wh/kg or 250-670 Wh/L). In addition, Li-ion battery cells can deliver up to 3.6 Volts, 3 times higher than technologies such as Ni-Cd or Ni-MH. This means that they can deliver large amounts of current for high-power applications, which has Li-ion batteries are also comparatively low maintenance, and do not require scheduled cycling to maintain their battery life. Li-ion batteries have no memory effect, a detrimental process where repeated partial discharge/charge cycles can cause a battery to 'remember' a lower capacity. This is an advantage over both Ni-Cd and Ni-MH, which display this effect. Li-ion batteries also have low self-discharge rate of around 1.5-2% per month. They do not contain toxic cadmium, which makes them easier to dispose of than Ni-Cd batteries.

# Battery Manufacturing Process



Flowchart illustrating the electrode fabrication process.

## Types of Li-ion Cell

- Cylindrical
- Prismatic
- Pouch

## Most Popular Li-ion battery chemistry.

- NMC - Lithium, Nickel, Manganese, and Cobalt oxide:  
NMC is known for high energy density, which means there will be more energy with the same amount of battery. A battery with high energy density but with a low cycle life. NMC batteries have been the subject of number of investigations around fire

- LFP - Lithium Iron Phosphate  
LFP is known as more stable chemistry, which means the temperature threshold for thermal runaway (or fire) is higher than that of NCM. LFP batteries are chipper than NMC

Electrode slurry can be prepared by two process

- Batch Process
- Continuous Process

*Batch Process is conventional method of preparation of slurry for the electrode whereas continuous process is used by some new technologies and it is under improvement.*

### BATCH PROCESS ADVANTAGE OVER CONTINOUS PROCESS

- Stable Process
- Flexibility for adding Raw material
- Can change recipe
- Can be cleaned with CIP
- Low Cost

*Ross's PDDM mixer is most effective for the Batch process.*

*Screw mixer is used for Continuous process*



## PDDM ADVANTAGE

### Scale-up principle

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Scale up design  
Modular design

### Slurry quality - Minimize batch differences

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High interchangeability  
Consistency| For different size mixers  
Stability| No viscosity change within 24 hours

### 30% power savings with improved efficiency

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Shorten mixing time  
2.5-4 hours to produce finished slurry  
50% savings in operating costs

*Higher efficiency of motor drive  
High gearbox transfer efficiency  
Low blade resistance, low power consumption*



Prepared by:

**Shital Bhat**

Process Manager

Ross Process Solution India Pvt Ltd, 301/302, Nyati Emporium, Mahalunge, Pune, India-411045

(100% owned by Charles Ross & Son Company, 710 Old Willets Path  
Hauppauge, New York 11788)