TOTAL SOLUTION PROVIDER FOR

ASSEMBLY PROCESS OF LITHIUM-ION RECHARGEABLE BATTERY
Establishment
2003~2009
Entered secondary battery equipment market

- Established mPLUS CORP. in 2003
- Developed ultrasonic Sc_Softwarea System for FPD
- Acquired ISO9001 certification
- Obtain an Order of A123 System Korea/China (Electrolyte injector, Assembly Line etc.)
- Established R&D center
- Selected as export promising small and medium enterprise (Chungbuk province business administration)
- Certified Inno-biz
- Certified venture company
- Awarded $1 million export
- Obtain an Order of A123 System USA Assembly Line
- Obtain an Order of SK innovation Notching M/C

Growth period
2010~2013
Established R&D capability client network

- Obtain an Order of 2010 Wanxiang Ev Notching M/C
- Obtain an Order of SK innovation Degasging M/C
- Awarded Knowledge Economy Minister Award in Korea venture business
- Awarded grand prize at Chungbuk province small and medium business technology conference
- Awarded Presidential prize on the 47th Trade day
- Awarded $10 million tower
- Relocation of office (Seosan-si, Chungbuk)
- Obtain an Order of SK innovation Notching and Packaging M/C
- Obtain an Order of Hyundai motor Pilot Line
- Selected as the best partner of SK innovation
- Developed High Speed Notching System
- Developed Fuel cell assembly equipment
- Obtain an Order of SK innovation Wetting, Stacking M/C
- Developed micromini Stack System
- Developed Pouch Type high speed assembly equipment

Take-off stage
2014~present
Started full response to electric car market

- Obtain an Order of Assembly Line Michigan university, USA
- Obtain an Order of Tianjin EV Notching M/C
- Obtain an Order of Wanxiang-A123 Notching M/C
- Obtain an Order of SK innovation Notch and Stack M/C
- Obtain an Order of Tianjin EV Notching M/C
- Obtain an Order of Workshop Energy Assembly Line
- Obtain an Order of Longpower System Assembly Line
- Obtain an Order of EVE Energy Assembly Line
- Obtain an Order of MGL(China) Notching
- Obtain an Order of SK Innovation Seosan line (Packaging, etc)
- Listed on KOSDAQ
BATTERY MANUFACTURING PROCESS

Coating process

Mixing → Coating → Pressing → Slitting

Finish cell

Aging
Formation

Formation process

Coating process

ASSEMBLY PROCESS

mPLUS Product line

1. Notching system
   Input | Output

2. Stacking system
   Input | Output

3. Tab Welding system
   Input | Output

4. Packaging system
   Input | Output

5. Degassing system
   Input | Output
Secondary Battery is a device that can be charged and used repeatedly after storing electricity, and because of their environmentally friendly and economic benefits, they are widely used in household appliances, transportation power grids, etc. In addition, due to the weight reduction, high voltage, and high-density trend, the lithium ion battery market is expanding which has superior performance to existing nickel metal hydride battery.

**NOTCHING SYSTEM**

Cutting notched electrode into a pitch-controlled sheet, then loading it into a magazine

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>MPNT-240P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine speed</td>
<td>Max 240PPM [as of 2017]</td>
</tr>
<tr>
<td>Roll size</td>
<td>Max. Dia. 600mm</td>
</tr>
<tr>
<td>Notching type</td>
<td>Notching mold type</td>
</tr>
<tr>
<td>Cutting Type</td>
<td>Knife cutting type</td>
</tr>
<tr>
<td>Electrode tension control</td>
<td>Max. 10kgf (Auto control)</td>
</tr>
<tr>
<td>Inspection</td>
<td>Vision System</td>
</tr>
<tr>
<td>Electrode Cleaning</td>
<td>Brush Suction</td>
</tr>
<tr>
<td>Electrode Stacking</td>
<td>Auto stacking [Magazine auto change]</td>
</tr>
<tr>
<td>Power</td>
<td>380V, 3P, 40kW</td>
</tr>
<tr>
<td>Dimension</td>
<td>6.5m(L) x 1.4m(W) x 2.2m(H)</td>
</tr>
</tbody>
</table>

**KEY FEATURES**

- High-speed notching stability improvement
- Model change flexibility & promptness
- Notching & cutting scrap handling improvement
### Stacking System
Stacking electrodes (anode/cathode) and separator

#### Key Features
- High-speed stacking & folding
- Vision align system: Detective electrode automatic discharge
- Double/multiple electrodes separation when electrodes feeding
- Separate double arms to reduce waiting time

#### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>MPST-075P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine speed</td>
<td>Max 0.75 sec/sheet [as of 2017]</td>
</tr>
<tr>
<td>Separator Roll size</td>
<td>Max. Dia. 300mm</td>
</tr>
<tr>
<td>Stack type</td>
<td>&quot;Z&quot; Folding stack type</td>
</tr>
<tr>
<td>Separator cutting Type</td>
<td>Knife cutting type</td>
</tr>
<tr>
<td>Electrode Supply</td>
<td>Magazine type (V/D Magazine)</td>
</tr>
<tr>
<td>Electrode align type</td>
<td>Vision System</td>
</tr>
<tr>
<td>Separator termination</td>
<td>Bonding type [TBD: Taping type]</td>
</tr>
<tr>
<td>Jelly roll winding pattern</td>
<td>Max 2 rotation</td>
</tr>
<tr>
<td>Power</td>
<td>380V, 3P, 45kW</td>
</tr>
<tr>
<td>Dimension</td>
<td>4.5m(L) x 4.0m(W) x 2.2m(H)</td>
</tr>
</tbody>
</table>

### Tab Welding System
Tab welding to the grid using ultrasonic welder

#### Key Features
- Foreign matters prevention & removal
- Position verification after horn & anvil installation
- Random stackable with tab position detection function

#### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>MPWL-015P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine speed</td>
<td>Max 15PPM [as of 2017]</td>
</tr>
<tr>
<td>Welding type</td>
<td>Ultrasonic welding type</td>
</tr>
<tr>
<td>Tab supply</td>
<td>Magazine type</td>
</tr>
<tr>
<td>Tab cleaning</td>
<td>Brush cleaning</td>
</tr>
<tr>
<td>Tab Inspection</td>
<td>Vision inspection</td>
</tr>
<tr>
<td>Jelly roll moving</td>
<td>Jelly roll pallet type</td>
</tr>
<tr>
<td>Particle control</td>
<td>Particle suction</td>
</tr>
<tr>
<td>Foil inspection</td>
<td>Vision system [TBD: Sensor]</td>
</tr>
<tr>
<td>Power</td>
<td>380V, 3P, 50kW</td>
</tr>
<tr>
<td>Dimension</td>
<td>8.5m(L) x 4.0m(W) x 2.2m(H)</td>
</tr>
</tbody>
</table>
PACKAGING SYSTEM
Consist of three separate processes, pouch forming, packaging and E/L filling process

DEGASSING SYSTEM
Getting rid the gas generated in pre-charging process

**SPECIFICATIONS**

**KEY FEATURES**
- Variety of pouch size applicable
- Sealing unit with rigid structure & Accurate position control by serve motor
- Apply pollution prevention unit
- Apply cell detection for cell tracking

<table>
<thead>
<tr>
<th>Model</th>
<th>MP9A-015P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine speed</td>
<td>Max 15PPM [as of 2017]</td>
</tr>
<tr>
<td>Pouch type</td>
<td>At pouch [Max dia. 400mm]</td>
</tr>
<tr>
<td>Sealing type</td>
<td>Heat sealing [Max 230°C]</td>
</tr>
<tr>
<td>Sealing inspection</td>
<td>Vision system</td>
</tr>
<tr>
<td>Soaking type</td>
<td>Vacuum soaking type [Max 130torr]</td>
</tr>
<tr>
<td>E/L Filling</td>
<td>Max 200g</td>
</tr>
<tr>
<td>Vacuum sealing</td>
<td>Max 10torr , Heat sealing type</td>
</tr>
<tr>
<td>Cell weight check</td>
<td>Loadcell type [per cell]</td>
</tr>
<tr>
<td>Cell loading type</td>
<td>Cell tray [Formation tray]</td>
</tr>
<tr>
<td>Power</td>
<td>380V, 3P, 170Kw</td>
</tr>
<tr>
<td>Dimension</td>
<td>25.8m(L) x 7.2m(W) x 2.2m(H)</td>
</tr>
</tbody>
</table>

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Model</th>
<th>MPDG-015P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine speed</td>
<td>Max 15PPM [as of 2017]</td>
</tr>
<tr>
<td>Rolling type</td>
<td>Steel roller type</td>
</tr>
<tr>
<td>Degassing type</td>
<td>Max 10torr, Heat sealing [Max 230°C]</td>
</tr>
<tr>
<td>Sealing thickness</td>
<td>±15um</td>
</tr>
<tr>
<td>Cell weight check</td>
<td>Loadcell type [per cell]</td>
</tr>
<tr>
<td>Pouch cutting type</td>
<td>Knife cutter</td>
</tr>
<tr>
<td>Folding &amp; forming</td>
<td>Roller type</td>
</tr>
<tr>
<td>Lot marking</td>
<td>Inkjet marking</td>
</tr>
<tr>
<td>Cell loading type</td>
<td>Cell tray [Formation tray]</td>
</tr>
<tr>
<td>Power</td>
<td>380V, 3P, 120Kw</td>
</tr>
<tr>
<td>Dimension</td>
<td>13.5m(L) x 7.4m(W) x 2.2m(H)</td>
</tr>
</tbody>
</table>

**KEY FEATURES**
- Minimize internal pollution of chamber
- Vacuum degree in chamber : Double sealing
- All 4-sides maintainable system
Fuel Cell is a future-friendly new energy that generates electric energy from hydrogen energy. mPLUS has the technology and experience to make turnkey from laminating to stack and inspection equipment.

**MEA LAMINATING SYSTEM**
Laminating Membrane and electrode

**PRODUCTION CAPA.**
Lab scale ~ Mass production
Speed : 500mm/min.

**KEY FEATURES**
- Automatic reel unwinding & rewinding system
- Cathode & Anode pattern roll lamination system
- Heating roll laminating
- Lot marking
- Particle suction system

**PRODUCTION CAPA.**
Lab scale ~ Mass production
Speed : 500mm/min.

**KEY FEATURES**
- Automatic reel unwinding & rewinding system
- Cathode & Anode pattern heat pressing system
- Vision align
- Precision temp. control
- Precision hot press
- Precision tension control
- Auto EPC system
**MEA PUNCHING SYSTEM**
Cutting MEA into a pitch-controlled sheet

**PRODUCTION CAPA.**
Lab scale ~ Mass production
Speed: 6 sheet/min

**KEY FEATURES**
- Automatic reel unwinding (Roll to Sheet)
- Auto punching system
- Vision align
- Auto EPC system
- Precision tension control
- Auto pick & place to magazine
- Automatic stack with protection sheet

**STACK PRESS SYSTEM**
Stacking MEGA and separator

**PRODUCTION CAPA.**
Lab scale ~ Mass production
Speed: 1-5 stack/day

**KEY FEATURES**
- Manual loading & unloading
- Recipe auto information
- Real time stacking vision inspection
- Stack height check by using laser & probe
- Stack flatness check by using laser & probe
- Servo pressing system

**INSPECTION SYSTEM**

**SEPA. PLATE PIN-HOLE INSPECTION SYSTEM**

**SEPA. PLATE THICKNESS MEASURING SYSTEM**