Battery & Fuel Cell

Advanced products need future processing technology

IKA® machines & process for the manufacturing of electrode slurries for battery and fuel cell applications
The benefits of using IKA® Inline dispersing technology

Scale Up

IKA® machines are proven and precise in scale-up by maintaining constant tip speeds, equivalent shear gaps and rotor-stator geometry. The constant specific energy input from lab to production machines results in predictable and reliable scale-up.

IKA® offers applications support with field testing and pilot lab facilities including particle size and characterization.

Zero contamination version

Advanced machine design with dispersing tools made from ceramic & non conductive DLC coating as an option.

Zero metal contamination for the treatment of sensitive or abrasive materials.

Batch process versus Inline process

- Energy input random
- Full deagglomeration is not guaranteed
- Less flexible batching

- Concentrated energy input
- Flexible capacity
- Deagglomeration in a single pass or by no. of passes resulting in a narrow particle range

Process efficiency – Improvement using an MHD inline system for powder incorporation

- 5 times quicker for the same production amount
- 10% energy demand for the same production amount
- 25% space requirement for the same production amount
- No manual cleaning of internals during production
- Suitable for continuous operation
- Mixing performance independent from production volume
BCP - Processing sequence

1. Metering the main liquid into the vessel with a flow counter
2. Metering the major solid ingredients by weight
3. Small amounts are pre-weight & filled into the feeding hopper
4. Start liquid circulation with DBI while dispersing the binder
5. After dissolving the binder, incorporation & dispersing of all other ingredients
6. Degassing of the product while re-circulating at small speed
7. Process through the IKA® MKO mill for fine dispersing in a single pass process with controlled flow rate
8. Major adjustment of the product temperature passing a heat exchanger. Fine adjustment in the buffer tank feeding the coating process.

SPP & DBI - Mixing & Pre-Dispersing unit

- Product inflow with wide cross section
- 2-stage pumping & dispersing
- Inflow to the lower stage can be bypassed
- Suction effect created by high product flow
- Liquid & solids direct feeding
- Feeding in the high turbulent area
- Machine creates sufficient pressure for re-circulation, discharge or CIP
- Discharging in the lowest machine point

MKO – Fine dispersing unit

- Inline dispersing unit with conical dispersing tool
- Adjustable shear gap for optimum efficiency
- Wide operating range of the tip speed
- Dispersing effect created by shear for viscous products
- Easy adjustment of the energy input by speed, residence time and shear gap setting
- Smooth surface versions to avoid damage of the particle shape
- Completely closed system suitable for pressure operation
- Dispersing chamber completely filled without gas contamination

BCP – Process benefits

- Separate feeding equipment for liquids and solids either manually or automatically
- No powder contamination of vessel or agitator parts, thus no cleaning during process
- High flexibility on variations in the raw materials and compound
- Degassing before the fine dispersing for easier removal of the air or inert gas bubbles
- The entire system is suitable for cleaning in place (CIP)
- Only one vessel for mixing and degassing thus less cleaning efforts
- No circulation or transfer pump required prior to coating process
- Flexibility in the production amount between 30 – 100%
- Easy to replace existing batch mixer with insufficient dispersing performance
- Suitable for nano-powder deagglomeration
- Mixing performance independent from the product viscosity
- Short piping with minimized product loss
**FCP – Process benefits**

- Full automatic feeding of solids and liquids
- 24/7 continuously running and no cleaning maintenance during processing
- Completely closed system reducing environmental and operator exposure
- Complete degassing before the fine dispersing for easier removal of the air/gas bubbles
- Increased solid concentration possible for shorter drying times
- The entire system is suitable for cleaning in place CIP
- Unlimited production amount just manufacturing the required quantity
- Easy adjustment of the energy input on the product properties
- Suitable for nano-powder deagglomeration
- Mixing performance independent from the product viscosity
- Very constant product viscosity for a smooth coating process
- One MHD with feeding system can replace several batch mixers with feeding systems

**FCP – Processing sequence**

1. Proportional feeding and dispersing of binder and solvent in MHD no.1 to make the binder solution storing in a buffer tank
2. Proportional feeding of binder solution and further solid ingredients in MHD no. 2 to make the premixed product
3. Degassing of the premixed product in a buffer tank or continuous de-aeration system
4. Flow controlled feeding of the degassed product in the MKO for fine dispersing with downstream temperature adjustment

**MHD – Mixing & Pre-dispersing**

- Proportional feeding of solids from top and liquids from side
- Solids pass an inlet auger which keeps the feeding line dry
- Liquid stream splitting in many small streams using an injector
- Premixing of solid and liquid with a pitched blade tool
- Further dispersing and discharge with a rotor-stator tool
- Solid content and flow rate given by the feeding systems
- Incorporation of up to 80% solids in one pass operation
- Achievable accuracy approx. 0.5% or better

**Patented**
BCP – Pilot Plant

The IKA® batch plant systems type MP or SPP are highly compact and flexible solutions for slurry dispersing. Full inline powder incorporation without contamination is easily achieved using the IKA® vessel bottom mounted dispersing unit type DBI.

Simulation of batch or semi-continuous processing.
- Batch volume 10 or 25 ltr
- Standard & Ex-proof executions available
- Total power requirement approx. 6 kW
- Space (L x W x H): 1000 x 1000 x 1600 mm

IKA® Inline dispersing plants - The ultimate R&D technology

FCP – Mini Plant

Integrating the IKA® magic LAB® modular system, the FCP-Mini is the smallest inline dispersing plant in the world.

Recipe development and other tasks using small sample volume is easily accomplished with the FCP.

The system provides precise scale and reliable results for scale-up to larger pilot and production IKA® technologies.
- Flow rate range 5 - 30 kg/h
- Sample volume 0,5 – 2,0 ltr
- Noise emission < 75 dB(A)
- Remote & data recording with computer
- Zero contamination version as option
- Total power requirement approx. 2,5 kW
- Space (L x W x H): 800 x 500 x 500 mm

FCP – Pilot Plant

The FCP Pilot Plant is a superior tool used in the development of processing methods and parameters or small capacity production demands.

Simulation of semi- or full continuous processing.
- Flow rate range 30 - 150 kg/h
- Batch volume 10 - 50 ltr
- Custom made designs
- PLC control with data recording
- Standard & Ex-proof executions available
- Zero contamination version as option
- Total power requirement approx. 10 kW
- Space (L x W x H): 2000 x 1000 x 1800 mm

Solids feeder
MHD Solid-Liquid Mixing
Flow meter
Temperature control
MKO Fine dispersing
Product buffer & Conditioning tank
Binder solving vessel
PLC control
Mobility
## Technical data

### DBI Plant Systems
**Batch inline mixing & dispersing**

<table>
<thead>
<tr>
<th>Capacity range [l]</th>
<th>3 - 10</th>
<th>8 - 25</th>
<th>15 - 50</th>
<th>30 - 100</th>
<th>75 - 200</th>
<th>150 - 500</th>
<th>300 - 1000</th>
<th>600 - 2000</th>
<th>1200 - 4000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tip speed DBI</strong> [m/s]</td>
<td>10 - 32</td>
<td>10 - 32</td>
<td>10 - 32</td>
<td>10 - 32</td>
<td>10 - 32</td>
<td>10 - 32</td>
<td>10 - 32</td>
<td>10 - 32</td>
<td>10 - 32</td>
</tr>
<tr>
<td><strong>Total power</strong> [kW]</td>
<td>4,4</td>
<td>4,4</td>
<td>8,1</td>
<td>8,3</td>
<td>23,1</td>
<td>23,5</td>
<td>25</td>
<td>49</td>
<td>52,5</td>
</tr>
<tr>
<td><strong>Max. viscosity</strong> [MPas]</td>
<td>30000</td>
<td>30000</td>
<td>50000</td>
<td>50000</td>
<td>50000</td>
<td>50000</td>
<td>50000</td>
<td>50000</td>
<td>50000</td>
</tr>
<tr>
<td><strong>Base size</strong> [mm]</td>
<td>630 x 650</td>
<td>1070 x 800</td>
<td>1220 x 860</td>
<td>1370 x 1080</td>
<td>1705 x 1250</td>
<td>2080 x 1350</td>
<td>2935 x 1765</td>
<td>3630 x 2270</td>
<td>4300 x 2600</td>
</tr>
<tr>
<td><strong>Height close / open</strong></td>
<td>1065 / 1515</td>
<td>1324 / 1445</td>
<td>1480 / 1695</td>
<td>1720 / 1990</td>
<td>2000 / 2460</td>
<td>2670 / 3085</td>
<td>3050 / 3760</td>
<td>3685 / 4530</td>
<td>4260 / 5250</td>
</tr>
<tr>
<td><strong>Weight approx.</strong> [kg]</td>
<td>300</td>
<td>250</td>
<td>330</td>
<td>360</td>
<td>700</td>
<td>1000</td>
<td>2100</td>
<td>3800</td>
<td>4500</td>
</tr>
</tbody>
</table>

* based on a standard recipe of approx. 50% solid content & final viscosity of approx. 15000 mPas  /  ** without product

### MKO
**Fine dispersing**

<table>
<thead>
<tr>
<th>Capacity range* [l/h]</th>
<th>3 - 10</th>
<th>15 - 50</th>
<th>40 - 150</th>
<th>110 - 400</th>
<th>300 - 1000</th>
<th>1100 - 4000</th>
<th>2500 - 8000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor power</strong> [kW]</td>
<td>0,9</td>
<td>2,2 - 4,0</td>
<td>5,5 - 7,5</td>
<td>11,0 - 18,5</td>
<td>22 - 37</td>
<td>55 - 90</td>
<td>75 - 160</td>
</tr>
<tr>
<td><strong>Tip speed</strong> [m/s]</td>
<td>23,6</td>
<td>22,7</td>
<td>22,9</td>
<td>23,8</td>
<td>21,5</td>
<td>24,3</td>
<td></td>
</tr>
<tr>
<td><strong>Inlet solid</strong> [DN]</td>
<td>25</td>
<td>50</td>
<td>65</td>
<td>80</td>
<td>100</td>
<td>175</td>
<td>250</td>
</tr>
<tr>
<td><strong>Inlet liquid</strong> [DN]</td>
<td>8</td>
<td>15</td>
<td>25</td>
<td>32</td>
<td>50</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td><strong>Blend outlet</strong> [DN]</td>
<td>8</td>
<td>15</td>
<td>32</td>
<td>50</td>
<td>65</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td><strong>Max. viscosity</strong> [MPas]</td>
<td>15000</td>
<td>30000</td>
<td>50000</td>
<td>50000</td>
<td>50000</td>
<td>50000</td>
<td>50000</td>
</tr>
<tr>
<td><strong>Size L x W x H</strong> [mm]</td>
<td>205 x 125 x 230</td>
<td>425 x 250 x 900</td>
<td>625 x 340 x 870</td>
<td>930 x 400 x 1230</td>
<td>1085 x 550 x 1330</td>
<td>1385 x 700 x 1530</td>
<td>1500 x 750 x 1620</td>
</tr>
<tr>
<td><strong>Weight approx.</strong> [kg]</td>
<td>6</td>
<td>45</td>
<td>80</td>
<td>250</td>
<td>600</td>
<td>1400</td>
<td>3500</td>
</tr>
</tbody>
</table>

* Motor of agitator & DBI  /  ** without product

### IKA® - Group Worldwide service

**North America**
- IKA® WORKS Inc. Wilmington, USA

**Europe**
- IKA® Werke GmbH & Co. KG Staufen, Germany

**Middle East**
- IKA® Werke GmbH & Co. KG Staufen, Germany

**Africa**
- IKA® Werke GmbH & Co. KG Staufen, Germany

**South America**
- IKA® WORKS Inc. São Paulo, Brazil

**Japan**
- IKA® Japan K.K. Nara, Japan

**China**
- IKA® Works Guangzhou Guangzhou, China

**Asia**
- IKA® Works (Asia) Kuala Lumpur, Malaysia

**Australia**
- IKA® Works (Asia) Kuala Lumpur, Malaysia

**India**
- IKA® India Private Limited Bangalore, India