Real-time Battery Electrode Slurry Quality Monitoring

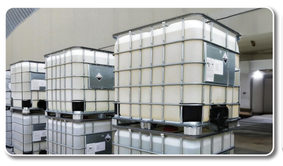
Batteries play a central role in modern life powering smartphones, electric vehicles, and renewable energy systems. As battery demand grows, the need for high-quality, efficient, and safe production methods becomes increasingly important.

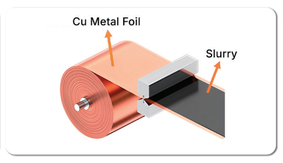
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Problem Statement

- Battery manufacturing is a rapidly growing industry that demands consistent quality and process control.
- Electrode slurry preparation remains largely research-driven, relying on manual, sampling-based measurements that lack real-time and autonomous data collection for large-scale processes like mixing, coating, and filling.
- Quality control needs vary across production stages, from incoming material inspection, requiring full traceability of high-value ingredients from multiple suppliers to process and final product assurance.

Lack of unified system to control battery electrode slurry across the complete ecosystem





Step	Materials	Mixing	Storage	Coating	Filling
What?	Receiving and Quality Control of Raw Materials	Slurry Formulation and Mixing	Slurry Storage and Transport	Electrode Coating	Electrolyte Dispensing and Cell Filling
Requirements	Verify Incoming Fluid Properties	Real-time Homogeneity Tracking	Maintain Slurry Stability	Precise Flow and Thickness Control	Ensure Proper Wetting and Activation
Current Method	Offline Sample and Test	"On the fly" Sample and Lab Test	Periodic sample tests with desktop equipment	Process is run "open-loop" with predetermined coater setting	Assumed-Quality Dispensing
Gap	Lack of 100% Inspection. "Spot check" method is slow.	Operators are "flying blind" between discrete lab tests.	No live visibility into the slurry's condition in the tank.	Lack of In-line Control Data.	No real-time verification of electrolyte meeting specifications.

Rheonics Solution

Sensor Introduction

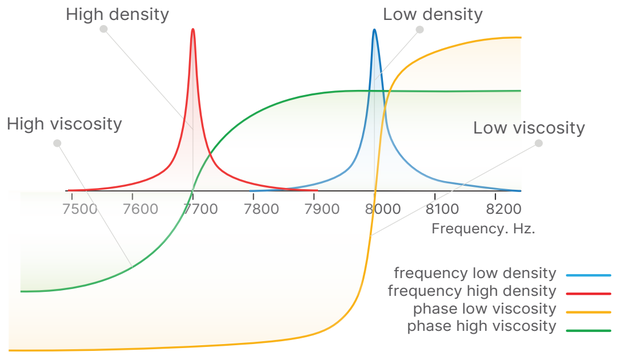




Ex certifications

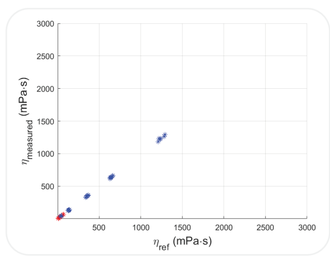
Hygienic certifications

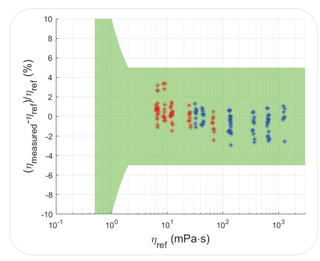
Resonance Response



- Patented BTR (Balance Torsional Resonator)
- technology.
- Unaffected by external vibrations.
- Plug and play design.
- Different certifications available for hazardous zones.
- Robust and hermetically sealed.

Measurements





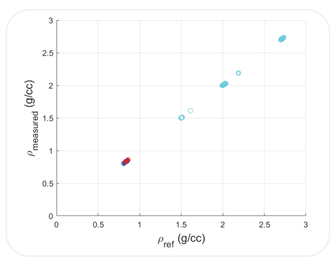
Rheonics SRV

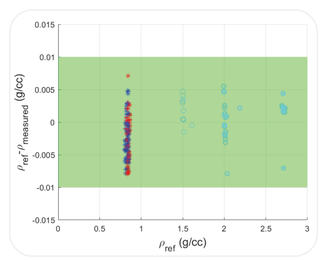
Viscosity Range
0.4–250,000+ cP

Reproducibility
Better than 1% of reading

Process Temp
-40°C to 300°C (-40°F to 575°F)

Pressure Rating
Up to 500 bar (7500 psi)





Rheonics SRD

Density Range
0.4–4.0 g/cc (0–4,000 kg/m³)

Viscosity Range
1 to 3,000 cP

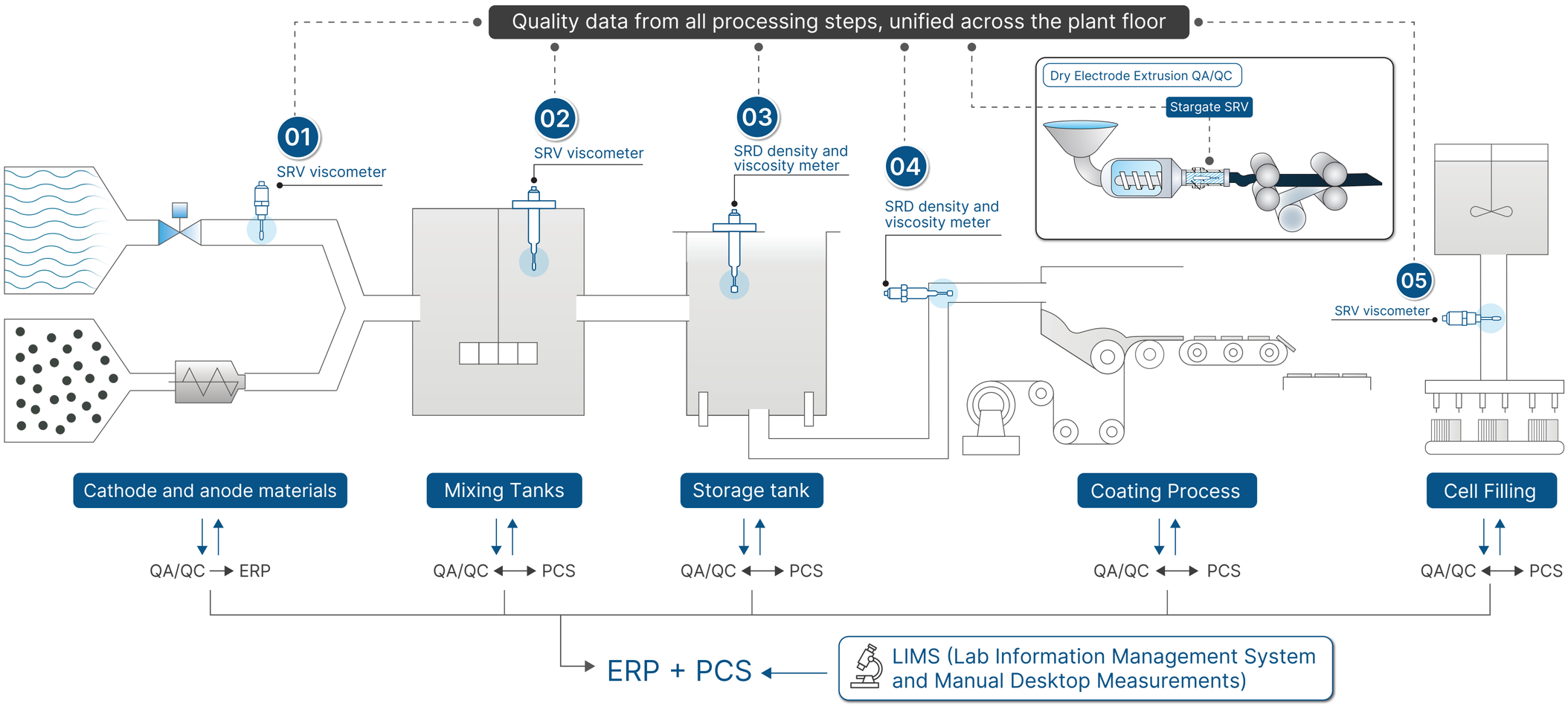
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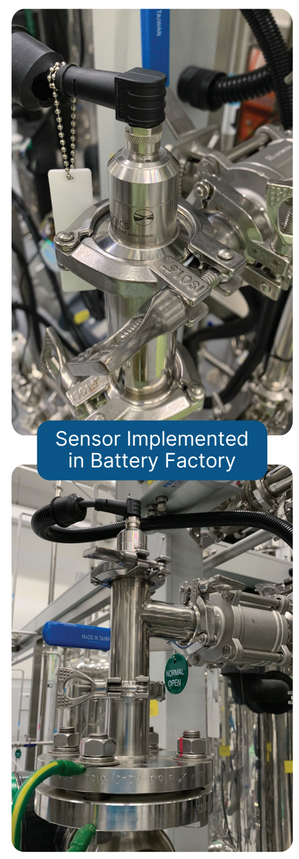
Process Temp
-40°C to 300°C (-40°F to 575°F)

Pressure Rating
Up to 500 bar (7500 psi)

Variants line: (Flush, short, long, varinline probes) with various Process connections (Thread, Flange, Tri-clamp, etc)

Sensor Implementation





Impact on KPI

Electrode slurry KPI
Viscosity · Homogeneity · Solid loading

Manufacturing Efficiency KPI
Mixing Time · Scrap Rate · Consistency

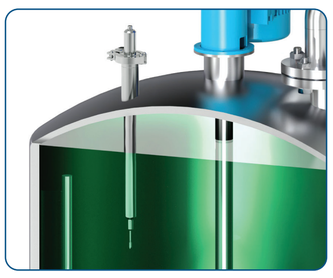
Cell Performance KPI
Coating Uniformity · Adhesion

Improved Electrode Slurry → Increased Manufacturing Yield → Enhanced Lifetime

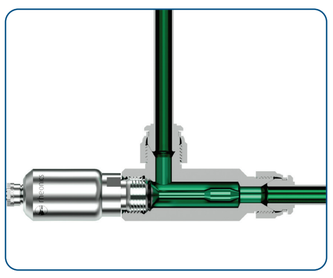
Recirculation line
SRD Density and viscosity meter



Tank Installation
SRV viscometer



Coating Line
SRV viscometer



Sources:
(1) Rheonics - Monitoring Battery Slurry Production with Inline Viscometers and Density Meters, (2) Rheonics - Battery production: Density and Viscosity Quality Control of Battery Slurry Mixing and Coating Lines

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