



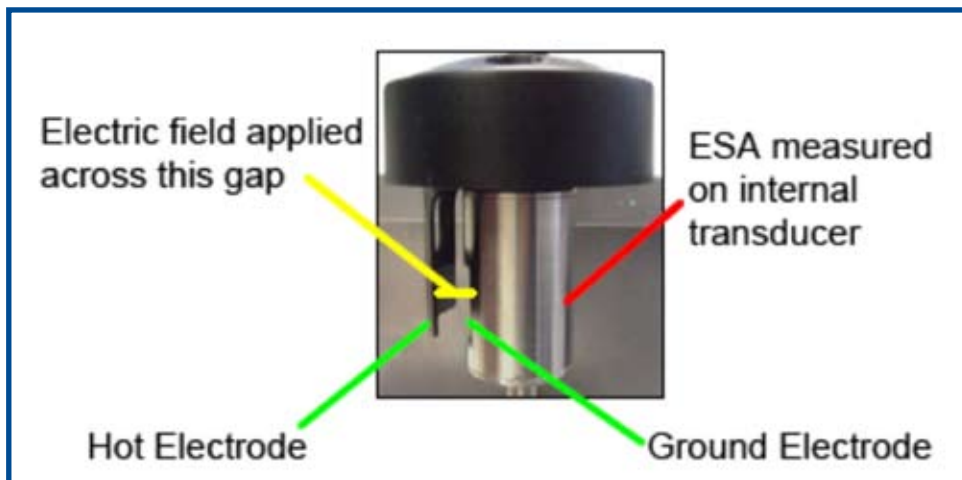
INDUSTRIAL TECHNOLOGIES PROGRAM

Evaluation and Development of a Prototype Electrokinetic Sonic Amplitude (ESA) System for On-Line Measurement of Charge in Papermaking Process Streams

An ESA System to Control the Wet End Paper-Making Process Through Zeta Measurement

Zeta potential, a measure of fiber voltage, determines the retention of fines, fillers, and the adsorption of polymers. Since zeta has a significant ability to alter sheet formation, its accurate measurement has the potential to control wet end chemistry in the papermaking process. Commercial attempts to gauge zeta potential are difficult and often inconsistent or restricted.

A method of measuring zeta potential of colloidal suspensions and spherical particles in the integrated circuit industry, electrokinetic sonic amplitude (ESA), is a prospective application in papermaking streams. This ESA technology provides continuous, real-time measurements from a simple flow-through sensor. This project researched the idea of using ESA to measure cationic demand in a real-time setting at high pulp consistencies.



Functionality of the ZetaProbe™ head



Benefits for Our Industry and Our Nation

- Provides continuous control over wet end chemistry
- Saves cost in papermaking additives
- Decreases build-up of colloidal material in the white water
- Increases water savings
- Improves potential for recyclability
- Reduces machine downtime due to loss of drainage control
- Allows greater substitution of cheaper paper fillers for more expensive pulp fibers
- Increases machine speeds and energy savings from lower steam requirements

Applications in Our Nation's Industry

Possible application points include coated broke pulpers, coated broke chests, recycled fiber chests, and virgin hardwood or softwood low density stock chests. This measurement potential also provides a means to track the adsorption of a polymer additive by fibers and fines or as a trouble-shooting device.

Project Partners

Pacific Northwest National Laboratory
Richland, WA

Institute of Paper Science and Technology
Atlanta, GA

Miami University
Oxford, OH

Project Description

Goal: To demonstrate a functional prototype of an ESA system for online measurement of zeta potential in papermaking process streams.

A test matrix was created to compare and reveal differences between the industry standard SC technique and the ESA technique for measuring cationic demand.

A ZetaProbe™ from Colloidal Dynamics™ was used to measure the cationic demand using the ESA technique. A Mutek charge analyzer was used to perform the streaming current (SC) technique for measuring cationic demand.

Results

- The feasibility of the ESA technology for use in an on-line instrument was inconclusive. Further engineering is required to generate a sufficient ESA signal from the paper pulp to obtain reliable and consistent measurements.
- The current industry standard method of cationic demand measurement (streaming current technique) was found to provide consistent measurements for various paper pulp batches, which could be empirically correlated to charge demand. However, the streaming current technique is not necessarily representative of the actual chemical reactions taking place in the paper stream and does not provide an absolute value of charge demand.
- The ESA technique using the ZetaProbe exhibited inconsistent paper pulp measurements, especially at lower fiber consistencies. High fiber percentages were used to increase ESA signal strength; however, handling difficulties were encountered precluding the ability to obtain representative measurements of the pulp samples.
- PNNL efforts to construct a small flow loop for material handling led to cost overruns; therefore, the remainder of the project focused on measurements in the existing chamber.

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A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



U.S. Department of Energy
Energy Efficiency
and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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