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Title

Automated Sample Preparation for CENS Embedded Sensors (SEN 7)

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Automated Sample Preparation for CENS Embedded Sensors

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Introduction: Why is Sample Preparation Necessary?

Particulates Will Clog Micromachined Sensors

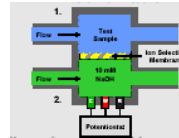
- **Micromachined channels are about 100 μm**
 - Any particles above channel size will clog sensor
 - Even particles less than channel size can clog membranes

		Sand			
Clay	Silt	Fine	Coarse	Gravel	
2 μm	20 μm	200 μm	2000 μm		
Particle Diameter					

International Society
of Soil Science

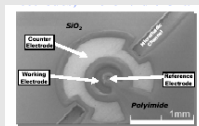
Sensors Need Calibration and Fluid Control

- Some CENS sensors require the movement of both samples and secondary fluids in a coordinated fashion
- Precipitate out fouling ions to enhance performance

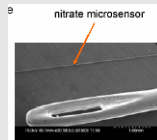


Problem Statement: Sensors in the Environment Need Sample Preparation

Nitrate Sensors Being Developed by the CENS Sensor Group



Micromachined Amperometric Nitrate Sensor



Micromachined Potentiometric Nitrate Sensor



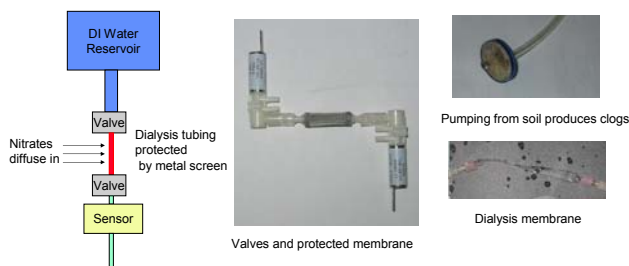
HPLC Chip Based Chemical Sensing

Needs of CENS sensors:

- small and accurate sensors developed by CENS researchers do not have sample preparation systems, and thus cannot be deployed into the field
- sample preparation systems must be small, low power, and automated
- some applications may require the concentration or dilution of ions to be measured

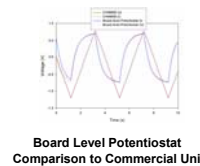
Basic Sample Preparation Setup: Combines Particulate Filter with a Ion-Diffusion Filter

Sample Preparation Flow Chart

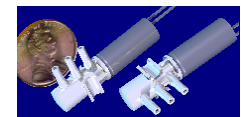


- Screen protects membrane
- Only small molecules can pass through membranes
- Only diffusion occurs through membrane, so clogging is minimized.
- Sample volume is kept small compared to the surrounding fluid
- The entire fluid volume from entrance to exit is pumped through the system between measurements to reduce contamination between samples
- Chemicals or calibration samples are pumped through as need

Fluidic and Electronic Control



Fluidic multiplexer for calibration



Latching Valve
(5.5mJ per switch)



Sensor control board

- Board Scale potentiostat is much cheaper and smaller than commercial potentiostat.
- Latching valve greatly reduces power consumption
- Multiplexer allows multiple calibration samples
- Wireless sensor board integrates sensor into network and controls the sensor with a potentiostat, D/A converter, A/D converter, and valve and pump control.