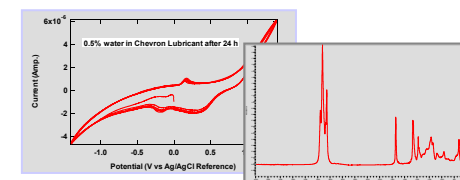


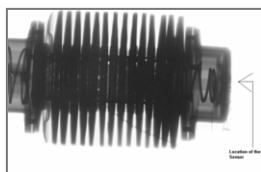
# Fluid Health Sensor: Technology Overview

- The MEMs fluid sensor is applicable to a wide range of fluid sensing applications – results are substantiated by laboratory tests and external technical publications.
- Not a product - proof-of-concept stage
- Initial focus was on industrial gears, bearings and aircraft lubricants – more activity now on process monitoring.
- Objective: Continuous *In-situ* monitoring of critical fluids
- Very Low Cost - simple fab process & sense elements
- Detects
  - Chemical (reducible) species
  - Temperature
  - Acidity (TAN / TBN / pH)
  - H<sub>2</sub>O content, dielectric analysis
  - Viscosity

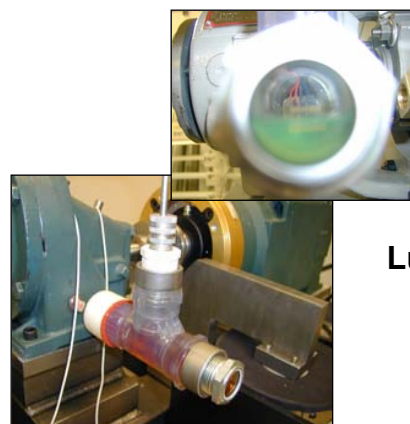


Fluid Analysis

X-Ray Image of oil sensor in HH-65 Oil Filter



Lube Sensor Monitoring Oil in Gearbox

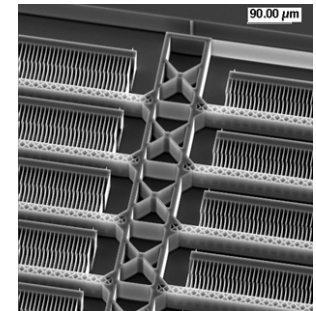


Lube Sensor in an industrial Pump

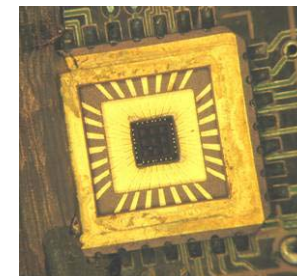
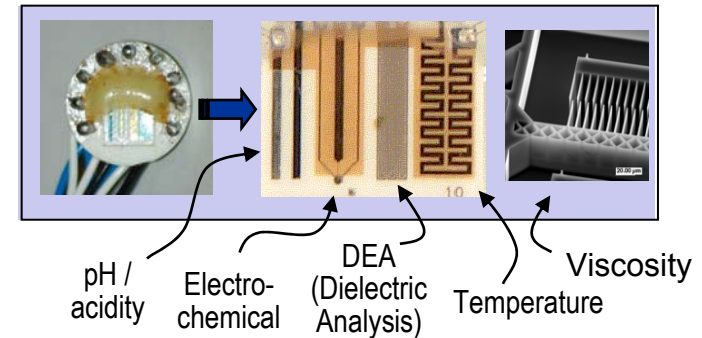


# Multi-Parameter Sensor Platform

- Suite of sensor elements determine process parameters in real-time
- Technology Components include:
  1. Multiple integrated sensor elements
  2. Sensor fusion algorithms
  3. Active sensor
  4. Custom sensor ASIC
  5. Sensor interface board with  $\mu$ -controller
  6. Feature extraction, modeling, and control algorithms



Multi-element sensor suite with MEMs viscosity Sensor



Fluid Sensor Custom ASIC (Application Specific Integrated Circuit)

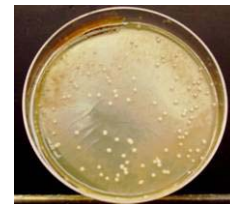
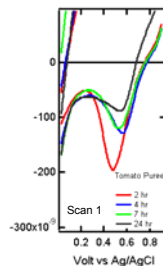
# Program Example: Microbial Sensing

## Sensor Development

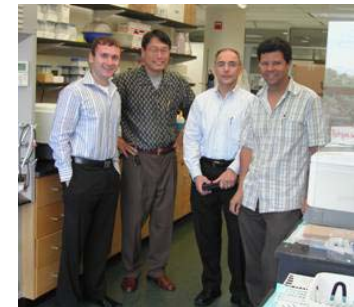
- Established a team of experts including Ohio State Univ. Food Safety, Center for Innovative Food Technology (CIFT), and Case Western Reserve Univ.
- Leveraging previous sensor developments in microbial detection, tomato bacteria sensing, water bio-sensing, and process modeling
- Samples cultured at Ohio State Univ. Food Science & Technology Lab
- MEMs sensor tested in various food products under conditions of progressive aging



MEMs bio-sensor with interface board and sample sensor response in aging tomato liquid



Bacteria cultured from food product



Rockwell & OSU Food Technology Experts meet to discuss sample cultures & bio-detection results