

## Engineering Nano-Characterization Center

B. R. Tittmann

Director of the Engineering Nano-Characterization Center

Department of Engineering Science and Mechanics.

Penn State University, University Park, PA 16802

The Engineering Nano-Characterization Center at Penn State conducts research in three areas of interest to the Shale Gas Industry: Robust Ultrasonic Sensors, Advanced Microscopy, and novel processing technology. Ultrasonic sensors developed in this lab have been designed to operate in extreme environments for a variety of applications including fluid flow, mechanical and fluid property measurement, and rapid flow inspections. The application of these sensors could be utilized to: enhance mud logging by providing continuous measurement of drilling fluid properties and flow rates, measure mechanical properties of geological formations, and provide continuous monitoring of critical drilling and production components such as pipes, joints, bearings, and welds for stress concentration and fracture. The advanced microscopic analysis techniques in this Center include the unique Scanning Acoustic Microscope (SAM) and state of the art ultra-high resolution imaging Atomic Force Microscope (AFM). These analytical techniques provide the unique abilities to image mechanical properties in the case of the SAM and image nanometer features in the case of the AFM. These techniques could be used to image the porosity and fracture characteristics of geological samples and investigate nano-scale technologies implemented in productions, such as proppants. Finally, the center hosts novel chemical processing approaches featuring high intensity ultrasound and microwave technologies called Multi-Energy Optimized Processing (MEOP). This technology focuses energy to specific reactants enhancing the rate of production and decreasing the required chemicals. Leveraging this technology could result in a technique for enhanced well stimulation or efficient and green water treatment solutions to the industry.