

MATERIALS SCIENTIST

Professional Overview

I am a Materials Science and Engineering professional with industry experience in R&D in the energy and air quality field; practiced in public speaking, technical writing, patent inventorship, multi-disciplinary teams, and client interaction. My background in education and photojournalism helps to bring creative insight and communication to my projects. Working within a heavily regulated landscape, and constantly monitoring regulatory implications, I've continued my education with training in Lean Six Sigma techniques, training in statistical analysis, as well as communication and data presentation.

Summary of Skills

- Materials Science and Engineering
- Materials Characterization
- Research and Development
- Multi-departmental teams
- Written and verbal communication.
- Nanofabrication
- Materials synthesis and processes
- Scale up and manufacturing

Education

Master of Science (M.S : Materials Science and Engineering , 2012 Colorado School of Mines i¼ City , State GPA: GPA: 3.79

Materials Science and Engineering GPA: 3.79

Bachelor of Science : Physics and Photojournalism , 2007 Western Kentucky University i¼ City , State

Physics GPA 3.92

GPA: GPA: 3.92

Accomplishments

- Lead multi-departmental team in successful redevelopment of 60% of the product line for improved injection performance.
- Four patents submitted as first inventor, for novel developments in product flow and improved baghouse performance.
- Advised key customers on injection design and resolved problematic mechanical issues.
- Implemented QA/QC standards, method development, and initiated SOPs for elemental analysis and powder rheology.
- Developed novel large scale testing apparatus, as well as a statistical model capable of predicting product performance under given system conditions.

Thesis/Dissertation

AN EXAMINATION OF PRECIPITATION AND DISSOLUTION

PRODUCTS OF CALCIUM CARBONATE IN A MARINE

ENVIRONMENT

Though CaCO_3 can be found in myriad environments around the globe, and has been studied for decades, a great deal of fundamental knowledge is still lacking concerning its precipitation, dissolution, crystal growth and interaction with its surroundings. This body of research becomes especially pertinent as levels of CO_2 in upper ocean waters continue to rise. This threatens not only the marine life actually made of calcium carbonate, but the variety of ecosystems dependent on it, including the human ones.

Before being able to accurately predict the repercussions of rising CO_2 though, one must rst understand the basic science behind the behavior of CaCO_3 in seawater. Consequently, this research examines two growth regimes, the rst over a period of 10 hours, and the second over a period of 45 days. Characterization takes place from the micro to the nano regimes, using such techniques as x-ray diraction, grazing incidence x-ray diraction, Raman, x-ray photoelectron spectroscopy, scanning electron microscopy, energy dispersive x-ray spectroscopy, and transmission electron microscopy.

This research concludes that CaCO_3 grows by the Stranski-Krastanov process, beginning with layer by layer growth. Lattice mismatch eventually transforms this to 3D island growth. Additionally, evidence was found that both high magnesian calcite and aragonite are present on the same growth planes. However, not every growth plane grows in the same way. The long growth experiment especially raises many interesting questions and potential directions for future work.

Professional Experience

Materials Scientist

August 2012 to Current Altria

- Research and Development of powdered activated carbon (PAC), including new product development, current product continuous improvement, troubleshooting and root cause analysis.

- Participates in assessing the voice of the customer in order to develop new products tailored to meet the needs of the marketplace, including products designed to optimized powder flow, reduce pressure drops in baghouses, and improved cleaning cycles.
- Works with Senior Vice President of Environmental and External Affairs on obtaining permit exceptions, and applying for new permits.
- Also attends meetings to summarize and communicate ongoing regulation development in emissions controls and adjacent fields.
- Works with QA/QC, and technical services in developing realistic and repeatable product specifications for performance testing of PAC, including upper and lower bounds of additives used in production, order of manufacturing process, regression analysis predictive of performance, QA/QC recommendations and procedures, and SOPs for laboratory technicians.
- May utilize independent laboratories, as needed, such as for certain thermal, x-ray, or elemental properties of the materials.
- Specifications may be based upon regulatory compliance, state agencies and air quality permits, and verified by laboratory tests developed.
- Targets include carbon properties and performance data.
- This may include ASTM testing, method development, and failure analysis.
- Evaluates PAC for gas emissions, particle size distribution, performance, and wear in customer sites.
- Analyzes and evaluates physical and chemical laboratory findings on all PAC in regard to actual production processes as well as product performance.
- Designs and conducts standard and novel trials to determine if PAC meets internal and external standards.
- Present evaluations across departments, such as to sales, production, and others to assist in determining the best path forward.
- Results also presented at industry conferences, and in patents.
- Works with manufacturing, vendors, and suppliers to identify new production and testing methods.
- Communicates with suppliers to troubleshoot PAC problems, such as materials corrosion, or coating methods.
- Discusses process capabilities and limitations of PAC production, including lead times, logistics, silo lot minimums, and standards of quality.
- Estimates costs and leads acquisition teams involved with production as well as laboratory equipment due to the introduction of new product lines, lending technical design assistance to members of production and engineering departments.
- Created specifications for instrumentation acquisitions that would meet development and quality demands effectively.
- Organizes and attends regular cross-departmental meetings to discuss development, troubleshooting, feedback on problems, equipment modifications, work processes and development.
- Working closely with chemical engineers, production engineers, chemists, technicians, management, sales, and energy customers to ensure all requirements are addressed.
- Traveling as needed, approximately 25-50%.
- Training in Lean Six Sigma approach, continuous improvement methods, and statistical analysis tools such as Minitab.
- Useful in monitoring process performance, yields, capability, cause-and effect relationships, and more.

Research Assistant

January 2009 to August 2012 Meso Scale Discovery

- Coursework including failure analysis, instrumentation, characterization, microscopy, materials, structures, crystallography, semiconductors, metallurgy, polymers, thermodynamics, ceramics.
- Thesis on the precipitation of calcium carbonate in seawater, a crystallographic component of a larger project focused on the carbon cycle in warm water reef areas.
- Initially part of a joint research project with Texas A&M.
- Additional graduate research on the use of silicon quantum dots in photovoltaic devices, and thin films, as part of the REMRSEC (Renewable Energy Materials Research Science Engineering Center) group, an interdisciplinary group on scientists and engineers working to make PV technology more affordable and scalable.
- Preparing and analyzing samples for SEM (Scanning Electron Microscope), TEM (Transmission Electron Microscope), XRD (X-Ray Diffraction), APT (Atom probe tomography), GI(Grazing Incidence)XRD, XPS (X-ray Photoelectron Spectroscopy) and Raman analysis.
- Methods include milling by FIB (Focused Ion Beam) Literature review, analyzing and documenting content, measurements, scientific writing.
- Teaching the FIB, SEM, TEM & XRD Laboratories, familiarizing students with science, use of the instruments, and independent training.
- Synthesis of mesoporous silica nanoparticles, using chemical surfactant methods.

Microelectronics Intern

January 2010 to January 2012 The Aerospace Corporation

- Successfully milling samples using Focused Ion Beam (FIB) to isolate 10nm quantum well (QW) in 100 nm wide needle for Local Electrode Atom Probe (LEAP) Scanning Transmission Electron Microscopy (STEM) analysis of QW in thin films, revealing failed or successful deposition.
- Acquisition of tomography dataset in STEM mode for transistor material Familiarity with IMOD tomography reconstruction software, DM (Digital Micrograph) acquisition and reconstruction software Literature review to optimize sample prep for Local Electrode Atom Probe (LEAP) analysis of III-V materials.

Supplemental Math Teacher

January 2008 Bronzeville Academic Center

- Further developed traits such as empathy, good communication, quick thinking, and the ability to visually illustrate a point using a variety of methods.
- Provide individual and small group math tutoring to students aged 16 - 21.
- Other roles in included substituting for all classes, participating in disciplinary hearings, reviewing senior portfolios, submitting corrections to Online Learning program, curriculum development.

Fellowships and Awards

Team Spirit Award, ADA Carbon Solutions May 2013

Scholarship recipient to attend “Materials for Renewable Energy” school in Erice, Italy; “3D Atomic Scale Imaging of Dopants in Quantum Structured Si”; SG McMurray, B Simonds, D Diercks, I Perez-Wurfl, Y. Heng-So, R Kirchofer, PC Taylor, BP Gorman; Colorado School of Mines, Golden, CO; The University of New South Wales, Sydney; July 2012

Distinguished Scholar Award, Microanalysis Society August 2011

“TEM and AtomProbe Investigation of Calcium Carbonate Precipitation in Seawater”; SG McMurray, DR Diercks, R Kirchofer, BP Gorman.

Presidential Scholar Award, Microscopy Society of America August 2010

“TEM Investigations of Amorphous Calcium Carbonate Formation in Seawater”; SG McMurray, BP Gorman.

Interests

Publications

Sorbent Compositions having Pneumatic Conveyance Capabilities

Sarah McMurray, Jacqueline Cecil de Peyer, Robert Huston, Joe Wong

United States 14/145,731 Filed 12/31/13

Baghouse Optimized Sorbent composition;

Sarah McMurray, Ariel Li, Robert Huston, Joe Wong.

United States 62/086,292 Filed 12/2/2014

Sorbents with Improved Flow Capabilities

Sarah McMurray, Brian Leen, Jacob Lowring.

United States 14/201,398 Filed 3/6/14

Temporary Agglomeration of Sorbent Particles to Improve conveyance and Sorption Properties

Sarah McMurray, Joe Wong, Robert Huston, Brian Leen

United States 62/083,630 Filed 11/24/2014

Papers and Lectures

Pilot High Sulfur TOXECON Baghouse with Activated Carbon Injection;

Sarah McMurray (ADA Carbon Solutions), Noah Meeks (Southern Company), Ramsay Chang (EPRI)

Electric Power Presented April 23, 2015

“3D Atomic Scale Imaging of Dopants in Quantum Structured Si;” SG McMurray, B Simonds, D Diercks, I Perez-Wurfl, Y. Heng-So, R Kirchofer, PC Taylor, BP Gorman; Colorado School of Mines, Golden, CO; The University of New South Wales, Sydney; July 2012

“TEM and AtomProbe Investigation of Calcium Carbonate Precipitation in Seawater;” SG McMurray, DR Diercks, R Kirchofer, BP Gorman. August 2011

“TEM Investigations of Amorphous Calcium Carbonate Formation in Seawater;” SG McMurray, BP Gorman. August 2010

Additional Information

Memberships and Affiliations

AICHE February 2015 – Present

R&D Work Life Balance Committee February 2015 – Present

One of a two member committee, duties included interviewing R&D colleagues, and using six sigma techniques to elucidate the voice of the customer to improve the R&D team's sense of work life balance.

Society of Women Engineers January 2012 – Present

Microanalysis society May 2012 – Present

Denver Kids – Mentor April 2011 - Present

Mentor to a Denver Public School student, in a “big sister” type role.

Employee Engagement committee May 2013 – January 2015

One of a 5 member company-committee, organized to offer opportunities for employee engagement, including health, nutrition, fitness, community service, and events. Responsible for engaging our community service partner for the year.

Skills

capital acquisitions, approach, APT, conferences, content, continuous improvement, curriculum development, failure analysis, laboratory equipment, laboratory tests, regulatory compliance, logistics, manufacturing process, Materials, math, Minitab, new product development, novel, obtaining permit, processes, quality, QA, quick, Research, sales, Scanning electron microscopy, scientific writing, Six Sigma, Lean, statistical analysis, Teaching, Transmission electron microscopy, troubleshoot, troubleshooting, tutoring, X-Ray, visual and verbal communication