

Karthika Sankar

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SUMMARY

PhD candidate at Boston University working in the field of electrochemical biosensors | Looking for summer internship opportunities with exposure to research in an industrial setting.

EDUCATION

Boston University, Boston, Massachusetts Aug 2017 - present
PhD candidate in **Materials Science and Engineering**. GPA: 3.87/4.0

Rice University, Houston, Texas Dec 2016
Master of Engineering in **Materials Science and NanoEngineering**. GPA: 3.87/4.0

Amrita School of Engineering, Coimbatore, India May 2015
Bachelor of Technology in **Chemical Engineering and Materials Science**. GPA: 9.08/10.0

RESEARCH EXPERIENCE

Boston University, Boston Sept 2017 - present
Development of progesterone sensor by DNA-Transcription (TF) factor affinity binding
Advisor: Mark Grinstaff & James Galagan

- Develop a surface probe system with DNA immobilized on a gold surface, bound to a TF having higher affinity for progesterone.
- Study label free and labeled sensing systems in presence of a redox mediator to capture the binding event electrochemically.
- Develop a reversible and continuous sensing system for progesterone detection.

Compare and test room temperature ionic liquids for lithium battery applications
Advisor: Mark Grinstaff

- Compare and characterize ionic liquids based on electrochemical window, ionic conductivity, viscosity and lithium transference number.
- Evaluate the performance of ionic liquids in lithium batteries and supercapacitors.

Development of enzymatic nicotine and lactate sensor
Advisor: Mark Grinstaff & James Galagan

- Developed electrochemical sensors using oxidoreductase enzymes.
- Performed chronoamperometric assay to obtain a relationship between current and analyte concentration.

Magna Imperio Systems Corp., Houston May 2016 - July 2017
Research and test various ion exchange membranes for Electro Nano Diffusion (END) process
Advisor: Ethan Demeter & Mickey Connor

- Compared electrode materials suitable for desalination and developed ways to improve the lifetime of electrodes.
- Selected ion exchange membranes based on properties like ionic conductivity, transference number, diffusion rate and pore size.
- Evaluated the performance of membranes in conjunction with electrodes using various electrochemical techniques to obtain the maximum desalination efficiency utilizing minimum energy.

Rice University, Houston Dec 2015 - May 2016
Evaluation of C-Bond Systems solutions on strength of glass
Advisor: Dr. Enrique Barrera

- Synthesized polymer solutions for pretreatment of glass sheets.
- Compared and evaluated the biaxial flexural strength of various glass sheets before and after treatment with C-Bond solutions using Instron and various characterization techniques.

Indian Institute of Technology, Madras

Jan 2015 - July 2015

Comparison of titanium based substrates for metal coatings

Advisor: Dr. Parasuraman Swaminathan & Dr. Lakshman Neelakantan

- Compared gold coating on titanium nitride film (TiN) and rose gold coating on titanium carbonitride (TiCN) film using characterization techniques like X-ray diffraction, Scanning electron microscopy, texture measurement and GIXRD.
- Evaluated the corrosion properties of the coatings after mechanical introduction of defects by indentation techniques.
- Analysed titanium aluminum nitride as an alternative to TiCN as a substrate for rose gold coatings.

Amrita School of Engineering, Coimbatore*Extraction of Phenol Using Ionic Liquids*

July 2014 - May 2015

Advisors: Dr. Duraisamy Kumaresan & Dr. Krishna Prasad

- Synthesized and purified two different ionic liquids to carry out the extraction of phenol from coal tar.
- Varied the extraction parameters (time of extraction, temperature of extraction, and recyclability of ionic liquids) and found the ionic liquid having propyl group had better extraction efficiency.

Indira Gandhi Centre for Atomic Research, Kalpakkam

May 2014 - Jul 2014

Development of Filter Media for Reprocessing Applications

Advisors: Dr. Kamachi Mudali (Head of Reprocessing Group) & Dr. Felix Lawrence

- Evaluated chemical and radiation resistances of three filter media (polyamide, polyimide and poly-phenylene sulfide) used for filtration of spent fuel from nuclear reactors.
- Conducted tensile strength measurements, pore size measurement, SEM analysis, permeability tests and found polyimide had superior properties over other media.

TEACHING EXPERIENCE**Boston University Teaching Assistant***CH 101 - Chemistry Lab I*

Fall 2017, 2018, Summer 2018

CH 102 - Chemistry Lab II

Spring 2018, 2019, Fall 2019

- Taught lab sessions on qualitative analysis, thermochemistry, spectroscopy, and electrochemistry
- Graded lab quizzes, reports and exams
- Mentored students during office hours and helped them prepare for exams

LABORATORY SKILLS

Biochemistry: Protein Synthesis/Purification, protein purification by HPLC, Circular Dichroism, Bio-Layer Interferometry, Plate reader based assays, estimation of concentration of DNA/protein and Gel Electrophoresis.

Materials Characterization: Significant experience with Optical Microscopy, Scanning Electron Microscopy (SEM), Energy Dispersive Spectroscopy (EDS), Dynamic Light Scattering (DLS), Atomic Force Microscopy (AFM), Rheometry, X-Ray Diffraction (XRD), Nanoindentation, and Microindentation.

Chromatography, Spectrometry, and Thermal analysis: Significant experience in spectrophotometry methods like Fourier Transform Infrared Spectroscopy (FT-IR), High Performance Liquid Chromatography (HPLC), Nuclear Magnetic Resonance Spectroscopy (NMR), NanoDrop, & Ultraviolet-visible spectroscopy (UV-Vis); MALDI-TOF, Thermogravimetric analysis (TGA), and Differential Scanning Calorimetry (DSC).

Material Testing: Previous exposure using Instron testing machine for mechanical testing; Electrochemical corrosion testing; and hardness measurement.

Electrochemical Techniques: Proficient in working with Potentiostat/Galvanostat for performing Cyclic Voltammetry, Electrochemical Impedance Spectroscopy (EIS), Chronoamperometry, and Potentiodynamic Polarization.

SOFTWARE SKILLS

Programming: MATLAB, C, and JAVA.

Chemical Engineering: Proficient in CAD, ASPEN HYSYS, and ASPEN Plus, a simulation software to solve Chemical Engineering problems.

Materials Science Tools: Significant knowledge in using softwares like *PowderCell*, *X'Pert HighScore Plus* & *OriginPro*.

AWARDS & FELLOWSHIPS

Boston University Research Fellowship

Sept 2017 - May 2022

Indian Academy of Science Fellowship - a prestigious science fellowship by Indian Academy of Sciences, Govt. of India for summer research work.

May 2014 - July 2014

PUBLICATIONS

- *Piperidinium ionic liquids as electrolyte solvents for sustained high temperature supercapacitor operation*, J. Varela, K. Sankar, A. Hino, X. Lin, W. Chang, D. Coker, M. Grinstaff; *Chemical Communication*, 2018. | [\[Link\]](#)

CONFERENCES

- *Materials Day, Boston University*: Poster presentation on *Optimization of DNA-based electrochemical sensors*, Sept 2019.
- *Materials Research Society, Fall Meeting, Boston*: Poster presentation on *Piperidinium ionic liquids as electrolytes in supercapacitors and lithium ion batteries at elevated temperatures*, Nov 2018.
- *Materials Day, Boston University*: Poster presentation on *Synthesis, characterization and comparison of phosphonium and piperidinium ionic liquid based electrolytes*, Sept 2018.
- *ACS National Meeting, Boston*: Oral presentation on *Piperidinium and phosphonium ionic liquids as electrolytes in supercapacitors and lithium ion batteries at elevated temperatures*, Aug 2018.
- *Annual Petrotech Conclave at University of Petroleum and Energy Studies, Dehradun, India*: Represented the University, won 2nd prize for a presentation on *India as a global research and development destination*, Feb 2014.

LEADERSHIP & ACTIVITIES

Vice President, American Society of Metals, Boston University Chapter

2018-present

Mentor for incoming graduate students in Materials Science & Engineering division at Boston University

Volunteer for STEM initiative for middle school students at Lincoln School, Boston