Bijoya Mandal

Physical /Analytical Chemist

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Ph.D. in Physical Chemistry with 5+ years of research experience in vibrational spectroscopy using ultrafast lasers and nonlinear optical spectroscopic techniques to study interfacial chemistry of materials.

Technical Skills

- Operation, troubleshooting, maintenance of ultrafast Ti:Sapphire lasers and amplifiers: (a) Coherent Mira 900 (b) Coherent Mira SEED (c) Coherent Libra to perform nonlinear spectroscopic experiments.
- Operation, troubleshooting and optimization of Collinear optical parametric amplifier (OPA): Light Conversion TOPAS Prime to generate mid-IR pulses for experiments
- Building and alignment of optical set-ups (steady state vibrational Sum Frequency generation (vSFG), Second Harmonic generation)
- Building and alignment of IR pump – vSFG probe dynamics set-up
- Operation and troubleshooting of UV-Vis spectrometer, Fourier Transform Infrared (FTIR) Spectrometer, LabRAM HR Evolution Confocal Raman microscope to characterize materials
- Proficient in data analysis software: IgorPro, Microsoft Office such as Word, Excel, PowerPoint, and Origin
- Basics of coding using MatLAB and Python for data fitting and analysis
- Basics of LabVIEW operation to run a home-built program for pump-probe experiments.
- Calculation of optical properties and vibrational features of molecules using Gaussian09 (Computational chemistry software package)
- Designed experiments and guided projects to newer direction when faced with roadblocks
- Designed an original research project (ORP) to study intermediate products formed in an electrochemical reaction using surface sensitive in-situ spectroscopy.
- Wrote lab protocols, detailed reports of experiments, scientific manuscripts, research proposals and peer reviewed scientific papers
- Presented scientific research in several national and international conferences
- Trained graduate and undergraduate students

Experience

Industrial Experience

Laser Processing & Engineering (LP&E) Summer Intern 2021, Corning Inc. Corning, NY

- Laser Processing of glass and ceramics materials.
- Alignment of laser set-ups
- One Corning restricted report (RTR) ***(In preparation).***

Research Experience

Graduate Research Assistant (Ph.D. candidate), Borguet Research Group, Temple University, PA

- Determine the origin of non-centrosymmetry in a centrosymmetric molecule (azide ion) at interfaces using non-linear spectroscopy such as vibrational sum frequency generation (vSFG) and second harmonic generation (SHG).
- Understand the interfacial solvent environment of various important mineral oxides such as Al_2O_3, SiO_2 and CaF_2 by studying vibrational spectroscopy and vibrational dynamics of IR probe molecules. Determined 3 times faster vibrational relaxation using IR pump – vSFG probe vibrational dynamics at oxide/D_2O interfaces compared to bulk D_2O.
- Spectroscopically measured the localized, spatially heterogeneous electric field of charged mineral oxide surfaces using the Stark active SCN^- molecule. Assigned local potential of +308 mV and -154 mV for positively, and negatively charged aluminol sites.
- Characterization of materials using UV-Vis, FTIR and Raman Spectroscopy.

Teaching Experience

Graduate Teaching Assistant, Temple University, PA

- General Chemistry Laboratory I (CHEM 1033) - Fall 2017
- Applications of Chemistry Laboratory (CHEM 1027) - Spring 2018
- Techniques of Chemical Measurement II (CHEM 4196) - Fall 2018
- STEM Scholars Seminar - Fall 2021, Spring 2022

Education

Ph.D. Candidate: Temple University, Philadelphia, USA **(09/2017- 05/2023)**

Thesis: Ultrafast Vibrational Spectroscopy and Dynamics of aqueous mineral oxide interfaces using IR probe molecules.

Master of Science: Physical Chemistry, IIT Kharagpur, India **(08/2015 – 05/2017)**

Thesis: Super halogen stabilized noble-gas compounds.

Bachelor of Science: Chemistry major, Presidency University, Kolkata**,** India **(08/2012 – 05/2015)**

Thesis: A Spectroscopic approach in Solvent effects.

Research Publications

1. **Bijoya Mandal**, Somaiyeh Dadashi, Mark DelloStritto, Stefan M. Piontek, Michael Klein, Eric Borguet* "Charged solutes show faster vibrational relaxation at oxide/water interfaces" ***(Submitted)***
2. **Bijoya Mandal**, Somaiyeh Dadashi, Eric Borguet* "Origin of non-centrosymmetricity in a centrosymmetric molecule(N_3^-) using vibrational Sum Frequency Generation (vSFG) Spectroscopy" ***(In Preparation)***
3. Stefan M. Piontek, Mark DelloStritto, **Bijoya Mandal**, Tim Marshall, Michael Klein, Eric Borguet* "Probing heterogeneous charge distributions at the α-Al_2O_3(0001)/water interface" J. Am. Chem. Soc., 142, 28, 12096–12105 (2020)
4. Ranajit Saha, **Bijoya Mandal**, P.K. Chattaraj* "$HNgBeF_3$ (Ng = Ar-Rn): Super-halogen supported noble gas insertion compounds" Int. J. Quantum Chem. 2017; e25499(1-12)

Leadership

- **Team leader, Nonlinear Optical Study of Interfaces, Borguet Research Group**
  Mentored 2 graduate and 3 undergraduate students in the basic operation of femtosecond lasers, OPA and nonlinear spectroscopy experiments at interfaces, provided guidance in data analysis/interpretation and meaningful scientific discussion.
- **Board member (Chemistry Department Representative), Graduate Student Organization (GSO)**
  Organized 3 career panel discussions and professional development workshops for graduate and undergraduate students.
- **Graduate Student Assistant for Emerging STEM Scholars (ESS) Program**
  Mentored 20 senior undergraduate students to make them STEM ready for their professional career.

Selected Awards

- Spring 2023 Doctoral Dissertation Completion Grant Award
- Daniel Swern Award for Outstanding Research 2021-2022
- Student Travel Award for ACS Spring 2021, Geochemistry Division

Seminars and Conferences

- 10th International Conference on Multidimensional Spectroscopy, 2022, Austin, TX (Poster presentation)
  Early Career Symposium at CMDS (Oral presentation)
- ACS Spring National Meeting, 2021 and 2022, (Oral presentation)
- LP&E Summer Internship Final Presentation, Corning, NY, 2021 (Oral presentation)
- 15th Annual Chautauqua Conference on Nonlinear Optics, Purdue University, IN, 2021 (Oral presentation)