Somaiyeh Dadashi

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Summary

As a Physical Chemist with expertise nanoscience and engineering, I have established a reputation for excellence in designing and developing nonlinear optical laser techniques for investigating interfacial and confined water at the intersection of geochemical, biological interfaces and nano materials. Furthermore, my extensive experience as a Materials/Nano engineer over six years has afforded me with in-depth expertise in synthesizing, analyzing, and characterizing nano and microstructured materials. My current research endeavors have led me to play a pivotal leadership role in constructing an interdisciplinary nonlinear optical microscopy and spectroscopy setup aimed at exploring material and bio substrate interfaces. Notably, I possess over six years of hands-on experience working with laser systems, and I have acquired scientific expertise in surface-specific vibrational laser spectroscopy and microscopy techniques, including sum-frequency generation (SFG) and second harmonic generation (SHG) processes. My scientific knowledge extends to the laser fabrication of nanostructured materials with potential impact in diverse fields such as optics and therapeutic applications.

Education

Ph.D., Chemistry, Temple University, Philadelphia, Pennsylvania, USA — 2018 –Present
Nonlinear Optical Studies of Interfaces
Advisor: Prof. Eric Borguet

M.Sc., Nanotechnology-Nanomaterials, Tarbiat Modares University, Tehran, Iran — 2014-2016
Laser Fabrication of Nanostructured Materials: Optical and Therapeutic Applications
Advisor: Prof. Reza Poursalehi
Co-Advisor: Dr. Hamid Delavari

B.Sc., Material Engineering- Industrial Metallurgy, University of Maragheh, East Azerbaijan, Iran — 2010-2014
Characterization of Hydroxyapatite and Fluorapatite
Advisor: Dr. Behnam Seyyedi

Research and Teaching Experience

Temple University, Chemistry Department, Philadelphia, Pennsylvania
Research Assistant, The Borguet Lab — 2019 –Present
Teaching Assistant, General Chemistry — 2018 –2019

Teaching Assistant, Chemistry Techniques I and General Chemistry laboratories 2018 –2019

Tarbiat Modares University, Department of Engineering, Tehran, Iran
Research Assistant, NSlab 2014–2017
Teaching Assistant, Advanced characterization of nanomaterials 2015
Teaching Assistant, Nanomaterial synthesis methods 2015

Iran Tractor Manufacturing Company, Tabriz, Iran
Apprenticeship, Quality Control Laboratory Aug 2014 – Sept 2014

Skills

The operation, maintenance, and repair of:
-Ultrashort pulse laser systems: Monaco (solid states), Libra and Mira 900 (Ti:Sapphire)
-Optical Parametric Amplifiers (OPA), Topas-PrimePlus and Opera-HP

Design and development of nonlinear optical techniques: Surface specific vibrational spectroscopy and microscopy of solid/liquid interface and performing time and phase resolved SFG and SHG
Skilled in laser spectroscopy, microscopy and optical instrumentation, nanofabrication by laser ablation and arc discharge
Wet lab and clean room skills

Software: LabView, Igor pro, Microsoft Office, Clemex, Chem draw, Chem office, Xpert High Score, Mercury, Gaussian, Origin, Match for XRD analysis, OriginLab, Mendeley, EndNote
Programming languages: Python, MATLAB
Markup languages: LaTeX
Advanced Analysis: UV-Visible, Near-IR and fluorescence spectroscopy, X-Ray diffraction analysis (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Fourier transform infrared spectroscopy (FT-IR), Photoluminescence (PL), X-ray photoelectron spectroscopy (XPS), Inductively coupled plasma (ICP), Raman spectroscopy and microscopy

Professional experience

– Lead development of time resolved high resolution nonlinear optical microscopy and spectroscopy system for interfacial studies: Geochemical and biological interfaces
– Lead development of multimodal (Near-IR, Mid-IR) nonlinear laser spectroscopy system with flexible experimental geometry: Geochemical and biological interfaces
– Investigation of structure of water at mineral interfaces using SFG spectroscopy
– Investigation of confined water at cell/substrate interface using SFG Microscopy
– Development of IR-SHG: A new nonlinear vibrational spectroscopy
– Studying interfacial solvent environment by measuring the vibrational lifetime of SCN^- molecular probe at the α-Al_2O_3 (0001) surface
– Probing heterogeneous electric field of charged mineral oxide surface, α-Al_2O_3 (0001) surface, using Stark active molecule such as SCN^-, NaN_3, acetonitrile
– Calculation of Fresnel equations for reflection and transmission geometry for SFG experiments at mineral oxide/liquid interfaces
– Studying interfacial properties of polystyrene nanoparticles using SFG spectroscopy

– CVD (Chemical vapor deposition) film coating: Coating Al_2O_3, SiO_2, CaF_2 with gold
– Synthesis and investigation of optical and photocatalytic properties of bismuth and bismuth oxide nanostructures by laser ablation in water and organic solvents
– Synthesis and investigation of optical properties of iron and iron oxide nanostructures by laser ablation in water and organic solvents
– Synthesis and investigation of Bi/Bi_2O_3@Au nanoparticles by laser ablation/chemical method as contrast agent for X-ray computed tomography
– Synthesis and characterization of Bi@PEG nanoparticles both by laser ablation and arc-discharge in polyethylene glycol as contrast agent for X-ray computed tomography
– Synthesis, characterization, and photocatalytic application of wide band gap oxide nanostructures
– Synthesis and characterization of bismuth and iron nano alloys by laser ablation in acetone, methanol, and deionized water
– Synthesis and characterization of copper and silver nano alloys by laser ablation in acetone
– Calculation of oxidation mechanism and optical properties of Bi/Bi_2O_3 nanoparticles by boundary element method, MNPBEM 14 toolbox-MATLAB
– Calculation of optical properties of Bi/Bi_2O_3 nanorods by boundary element method, MNPBEM 14 toolbox-MATLAB

Leadership experience

– Lead graduate student for construction and design of time-resolved high resolution nonlinear SHG and SFG microscope
– Mantananing collaborative
– Fostered cross-functional collaboration among researchers and engineers to design a state-of-the-art nonlinear optics laboratory, which required deft communication skills and a strategic, cross-disciplinary approach to problem-solving.
– Mentoring undergraduate student for construction of SFG microscope, providing consistent feedback
– Maintained vigilance and conducted regular assessments of the optics laboratory equipment and systems, investigating and evaluating existing optical/optomechanical components and electronic systems, to ensure optimal functionality and efficiency

Publications

1. Neda Iranpour Anaraki, **Somaiyeh Dadashi,** Chapter two: Cancer Therapy by Microwaves Hyperthermia, Electromagnetic Waves-Based Cancer Diagnosis and Therapy: Principles and Applications of Nanomaterials, (2023), Elsevier, ISBN: 9780323996280.
2. Bijoya Mandal, **Somaiyeh Dadashi**, Mark DelloStritto, Stefan M. Piontek, Michael L. Klein and Eric Borguet, Charged Solutes Show Faster Vibrational Dynamics at Oxide/Water Interfaces, To be submitted.
3. **Somaiyeh Dadashi,** Shyam Parshotam, Bijoya Mandal, Julianne Gibbs, Eric Borguet, Local electric fields at charged oxide interfaces and their influence on the organization of polar solvents, To be submitted.

4. **Somaiyeh Dadashi**, Bijoya Mandal, Eric Borguet, Near-IR second harmonic generation: A new nonlinear vibrational spectroscopy to investigate anharmonicity and dissociation energy at interfaces. To be submitted.
5. **Somaiyeh Dadashi,** Narendra M Adhikari, Stefan Piontek, Zheming Wang, Kevin Rosso, Eric Borguet, Determining the interfacial refractive index of water using surface specific vibrational sum frequency spectroscopy, Manuscript in progress.
6. **Somaiyeh Dadashi,** Aashish Tuladhar, Olivia Martin, Bijoya Mandal, Rick Remsing, Eric Borguet, Impact of nuclear quantum effects on interfacial hydrogen bonding networks. Manuscript in progress.
7. Bijoya Mandal, **Somaiyeh Dadashi**, Eric Borguet, Detecting centrosymmetric molecules at interfaces by vibrational Sum Frequency Generation Spectroscopy, Manuscript in progress.
8. Wasim Nawaj, Ayan Bhattacharyya, **Somaiyeh Dadashi**, Belinta Naomi Simiyu and Eric Borguet, Self-Assembled Monolayers of Alkanethiols on oxide surfaces, Manuscript in progress
9. **S. Dadashi**, R. Poursalehi, and H. Delavari, Optical and Structural Properties of Oxidation Resistant Colloidal Bismuth/Gold Nanocomposite: An Efficient Nanoparticles Based Contrast Agent for X-ray Computed Tomography, Journal of Molecular Liquids. 254, 12-19, (2018). https://doi.org/10.1016/j.molliq.2018.01.069
10. **S. Dadashi**, R. Poursalehi, and H. Delavari, Stability, size, and optical and structural properties of Bismuth Based nanoparticles prepared by laser ablation in different carriers, Applied Physics A, 124:406, (2018). https://doi.org/10.1007/s00339-018-1817-9
11. **S. Dadashi**, R. Poursalehi, and H. Delavari, Formation, gradual oxidation mechanism and tunable optical properties of Bi/Bi_2O_3 nanoparticles prepared by Nd:YAG laser ablation in liquid: Dissolved oxygen as genesis of tractable oxidation, Materials Research Bulletin, 97, 421-427, (2018). https://doi.org/10.1016/j.materresbull.2017.09.029.
12. **S. Dadashi**, R. Poursalehi, and H. Delavari, PEGylated Bi Nanoparticles Prepared via Pulsed Nd:YAG Laser Ablation in liquid PEG: An Efficient Contrast Agent for X-ray Computed Tomography, Journal of Computer Methods in Biomechanics and Biomedical Engineering: Imaging and Visualization, 7:4, 420-427, (2018). https://doi.org/10.1080/21681163.2018.1452634.
13. **S. Dadashi**, R. Poursalehi, and H. Delavari, Structural and Optical Properties of Pure Iron and Iron Oxide Nanoparticles Prepared via Pulsed Nd:YAG Laser Ablation in Liquid, Procedia Material Science, 11, 722-726, (2015). https://doi.org/10.1016/j.mspro.2015.11.052.
14. **S. Dadashi**, R. Poursalehi, and H. Delavari, Optical properties and colloidal stability mechanism of bismuth nanoparticles prepared by Q-switched Nd: YAG laser ablation in liquid, Procedia Material Science, 11, 679-683, (2015). https://doi.org/10.1016/j.mspro.2015.11.027.

Conferences

- **Somaiyeh Dadashi**, Hao Li, Bijoya Mandal, Eric Borguet, NIR-vSHG: A new nonlinear vibrational spectroscopy of interfaces, Optica Laser Congress, October 08-12, 2023, Greater Tacoma Convention Center, Washington.

- **Somaiyeh Dadashi,** Narendra M Adhikari, Stefan Piontek, Zheming Wang, Eric Borguet, Determining the interfacial refractive index of water using surface specific vibrational sum frequency spectroscopy, Gordon Research Seminar, July 30 - 31, 2022, Bryant University, Poster. Student Travel Award from Temple University.
- **Somaiyeh Dadashi,** Aashish Tuladhar, Bijoya Mandal, Rick Remsing, Eric Borguet Impact of nuclear quantum effects on vibrational relaxation dynamics of interfacial water, July 31 - Aug 5, 2022, Bryant University, Gordon Research Conference, Poster. Student Travel Award from Temple University.
- Bijoya Mandal, **Somaiyeh Dadashi**, Mark DelloStritto, Stefan Piontek, Michael Klein, Eric Borguet. Charged solutes show faster vibrational relaxation at oxide/water interfaces, June 21-24, 2022, 10th International Conference on Multidimensional Spectroscopy, Austin Texas, Oral presentation. Student Travel Award from Temple University.
- **Somaiyeh Dadashi**, Bijoya Mandal, Aashish Tuladhar, Eric Borguet, Impact of nuclear quantum effects on interfacial hydrogen bonding network, ACS National Meeting Spring 2022, Division of Physical Chemistry, March 20-24, Oral presentation. Student Travel Award from Temple University.
- Bijoya Mandal, **Somaiyeh Dadashi**, Eric Borguet, Detecting centrosymmetric molecules at interfaces by vibrational sum frequency generation spectroscopy, ACS National Meeting Spring 2022, Division of Geochemistry, March 20-24, Oral presentation.
- Joy Zou, Bijoya Mandal, **Somaiyeh Dadashi**, Mark DelloStritto, Michael Klein, Eric Borguet**,** Probing the vibrational density of states (VDOS) at oxide-aqueous interfaces**,** ACS National Meeting Spring 2022, Division of Geochemistry, March 20-24, Oral presentation.
- **Somaiyeh Dadashi**, Bijoya Mandal and Eric Borguet, Influence of the spatially heterogeneous charge distribution on α-Al_2O_3(0001) on the interfacial organization of acetonitrile-water mixtures, ACS National Meeting Spring 2021, Division of Geochemistry, April 5-16, Oral presentation.
- Bijoya Mandal, **Somaiyeh Dadashi**, Mark DelloStritto, Michael Klein, Eric Borguet, Charged solutes show faster vibrational relaxation at oxide/water interfaces, 10th International Conference on Multidimensional Spectroscopy; Austin Texas, June 21-24, Oral presentation.
- Bijoya Mandal, **Somaiyeh Dadashi**, Mark DelloStritto, Stefan Piontek, Michael Klein, Eric Borguet, Probing the interfacial solvent environment by measuring the vibrational lifetime of SCN^- at the α-Al_2O_3(0001) aqueous interface, ACS National Meeting Spring 2021, Division of Geochemistry, April 5-16, Oral presentation.
- **Somaiyeh Dadashi**, Eric Borguet, Vibrational Sum Frequency Generation Microscope, Chautauqua on Nonlinear Optics 2020, Department of Chemistry, Purdue University, West Lafayette, Indiana, May 18-22, Oral presentation.
- **Somaiyeh Dadashi**, Eric Borguet, Nonlinear Optical Studies of Interfaces, Siegman International School on Lasers, University of Rochester, July 2019, Poster presentation.
- **S. Dadashi**, R. Poursalehi, and H. Delavari, Optical and Structural Properties of Bismuth Nanoparticles Prepared by Pulsed Nd:YAG Laser Ablation in Liquid, 22nd Iranian Conference on Optic and Photonic, 26-28 January 2016, Poster presentation.

– R. Poursalehi, **S. Dadashi**, Synthesis of Cu-Ag Nanoparticles by Pulsed Nd:YAG Laser Ablation of Bulk Alloyed Target in Different Liquid Environments, 4th Conference on Advanced Nanoparticle Generation and Excitation by Lasers in Liquids, Germany, 9-12 May 2016, Poster presentation.

Workshops

–Chautauqua on Nonlinear Optics, Department of Chemistry, Purdue University, May 2021
–Chautauqua on Nonlinear Optics, Department of Chemistry, Purdue University, May 2020
–Siegman International School on Lasers, University of Warsaw, July 2020
–Femto-UP: Ultrafast lasers technologies and applications, Mar 2020
–Siegman International School on Lasers, University of Rochester, July 2019
–CST Summer Workshop on Computing and Statistics, June 2019
–An Introduction to application of MATLAB, Tarbiat Modares University, 2015

Honors and awards

– Gordon Research Seminar; Vibrational Spectroscopy: Outstanding poster award, July 2022.
– Spectra Physics Grant for Siegman International School on Lasers, University of Rochester, July 2019.
– Honored and awarded for the best dissertation, Department of Materials Science and Engineering, Tarbiat Modares University, 2017.
– Honored as an outstanding student for a successful dissertation defense in Department of Materials Science and Engineering, Tarbiat Modares University, 2017

References

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