

## Somaiyeh Dadashi

Department of Chemistry

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[Researchgate.net/profile/Somaiyeh-Dadashi](https://Researchgate.net/profile/Somaiyeh-Dadashi)

### Summary

Experienced and proactive scientist/engineer with over five years in femtosecond and nanosecond laser technologies, optical assemblies, and an additional six years in nanoscience and materials engineering. I have led the development of an interdisciplinary nonlinear optical spectroscopy and microscopy setup for studying interfaces, utilizing sum-frequency and second harmonic generation processes. My extensive background as a materials/nano engineer has equipped me with in-depth knowledge in synthesizing, analyzing, and characterizing nano- and microstructured materials for applications ranging from optics to therapeutics. I am keen to leverage my interdisciplinary skills in research areas that include innovative light-based techniques, bio-interfaces, nanostructured materials, atmospheric chemistry, ultrafast dynamics, and photonics.

**Immigration status: I-140 NIW petition approved for EB2 category.**

**Awaiting due date to file adjustment of status (I-485) application with USCIS**

### Education

Ph.D., Chemistry, Temple University, Philadelphia, Pennsylvania, USA 2018 –Present

*Development of multi-modal nonlinear spectroscopy for interfacial study*

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., Materials 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, Borguet Research group

2019 –Present

-Teaching Assistant, General Chemistry; recitation

2018 –2019

-Teaching Assistant, Chemistry Techniques I and General Chemistry lab	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 – Sept 2014

## Publications

1. **Somaiyeh Dadashi**, Shyam Parshotam, Bijoya Mandal, Benjamin Rehl, Julianne Gibbs, Eric Borguet, Influence of charged site density on local electric fields and polar solvent organization at oxide interfaces. *The Journal of Physical Chemistry C*, 128, 23, 9683–9692 (2024). <https://doi.org/10.1021/acs.jpcc.4c00306>.
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, Under review: *Journal of the American Chemical Society*, 2024.
3. **Somaiyeh Dadashi**, Narendra M Adhikari, Hao Li, Stefan Piontek, Zheming Wang, Kevin Rosso, Eric Borguet, Determining the dielectric constant of liquid/solid interfaces. Submitted to *Physical Review Letters*. arXiv: <https://doi.org/10.48550/arXiv.2406.15964>.
4. Bijoya Mandal, **Somaiyeh Dadashi**, Koichi Kumagai, Tomonori Hirano, Tatsuya Ishiyama, Salsabil Abou-Hatab, Akihiro Morita, Eric Borguet, Detecting Centrosymmetric Molecular Ions at an Interface by Vibrational Sum Frequency Generation Spectroscopy. To be submitted.
5. **Somaiyeh Dadashi**, Ziyad Thekkayil, Aashish Tuladhar, Olivia Martin, Bijoya Mandal, Rick Remsing, Eric Borguet, Impact of nuclear quantum effects on interfacial hydrogen bonding networks. Manuscript in preparation.
6. **Somaiyeh Dadashi**, Ziyad Thekkayil, Bijoya Mandal, Eric Borguet, Near-IR second harmonic generation: A new nonlinear vibrational spectroscopy of interfaces. Manuscript in preparation.
7. Wasim Nawaj, **Somaiyeh Dadashi**, Ayan Bhattacharyya, Amuthan Dekshinamoorthy, Belinta Naomi Simiyu and Eric Borguet, Self-Assembled Monolayers of Alkanethiols on oxide surfaces. Manuscript in preparation.
8. N. Iranpour Anaraki and **S. Dadashi**, in *Electromagnetic Waves-Based Cancer Diagnosis and Therapy*, edited by M. Khafaji, and O. Bavi (Academic Press, 2023), pp. 65-88, [ISBN: 9780323996280. https://doi.org/10.1016/B978-0-323-99628-0.01002-9](https://doi.org/10.1016/B978-0-323-99628-0.01002-9).
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<sub>2</sub>O<sub>3</sub> 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 Materials 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 Materials 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.
- **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.
- **Somaiyeh Dadashi**, Bijoya Mandal and Eric Borguet, Influence of the spatially heterogeneous charge distribution on  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>(0001) on the interfacial organization of acetonitrile-water mixtures, *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.

### Coauthored conference presentations

- Joy Zou, Mark DelloStritto, Bijoya Mandal, Hao Li, **Somaiyeh Dadashi**, Michael Klein, Eric Borguet, Ultrafast Vibrational Sum Frequency Dynamics of SCN<sup>-</sup> and the Impact of Interfacial Hydrogen-Bonding Networks on the Vibrational Density of States, APS March 2024.
- 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.
- 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.
- Bijoya Mandal, **Somaiyeh Dadashi**, Mark DelloStritto, Stefan Piontek, Michael Klein, Eric Borguet, Probing the interfacial solvent environment by measuring the vibrational lifetime of SCN<sup>-</sup> at the  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>(0001) aqueous interface, ACS National Meeting Spring 2021, Division of Geochemistry, April 5-16, Oral presentation.

### Honors and awards

- Daniel Swern Fellowship for Outstanding Research, Chemistry Department, Temple University, 2023.
- 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 master's thesis, Department of Materials Science and Engineering, Tarbiat Modares University, 2017.
- Honored as an outstanding student for a successful thesis defense in Department of Materials Science and Engineering, Tarbiat Modares University, 2017

### 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 interfaces and performing steady state and time 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

Advanced Analysis: UV-Visible, Near-IR and fluorescence spectroscopy, Fourier transform infrared spectroscopy (FT-IR), Photoluminescence (PL), X-Ray diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), X-ray photoelectron spectroscopy (XPS), Inductively coupled plasma (ICP), Raman spectroscopy and microscopy

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: L<sup>A</sup>T<sub>E</sub>X

### **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
- Time-Resolved vSFG (IR Pump–vSFG Probe) of water, heavy water and probe molecules
- Probing heterogeneous electric field of charged mineral oxide surface,  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> (0001) surface, using Stark active molecule such as SCN<sup>-</sup>, NaN<sub>3</sub>, 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<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, CaF<sub>2</sub> 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<sub>2</sub>O<sub>3</sub>@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<sub>2</sub>O<sub>3</sub> nanoparticles by boundary element method, MNPBEM 14 toolbox-MATLAB
- Calculation of optical properties of Bi/Bi<sub>2</sub>O<sub>3</sub> 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
- Maintaining collaborative projects leading to 5 manuscripts.
- 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 leading to 3 manuscripts.
- Mentoring undergraduate student for construction of SFG microscope, providing consistent feedback
- Maintained the optics laboratory equipment and systems, investigating and evaluating existing optical/optomechanical components and electronic systems, to ensure optimal functionality and efficiency

### 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

### References

Professor Eric Borguet, Hazel Tomlinson Professor of Chemistry, Department of Chemistry, Temple University. United States.

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Professor Hai-Lung Dai, Laura H. Carnell Professor of Chemistry, Department of Chemistry, Temple University. United States.

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Professor Spiridoula Matsika, Department of Chemistry, Temple University. United States.

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Professor A. Marjatta Lyyra, Physics Department. Temple University. United States.

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Dr. Reza Poursalehi, Department of Materials Engineering, Tarbiat Modares University, Tehran, Iran.

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