

# Tim Marshall

## Research Interests

Nonlinear spectroscopy, Nanomaterials, Transition metal dichalcogenides, Perovskites, Interfacial chemistry

## Research Experience

- 12/2016- **Ph.D. Researcher:** Nonlinear optical studies of interfaces; Dr. Eric Borguet, Temple University
- Advance the understanding of water wetting and ice nucleation on  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> surfaces using vibrational sum frequency generation (vSFG) spectroscopy.
  - Understand the behavior noncentrosymmetric perovskites and their surfaces in the presence of water using second harmonic generation (SHG).
  - Evaluate and quantify two-dimensional materials using Raman spectroscopy.
- 10/2013-12/2015 **Undergraduate Researcher:** La<sub>0.8</sub>Sr<sub>0.2</sub>Ga<sub>0.8</sub>Mg<sub>0.2</sub>O<sub>3- $\delta$</sub>  (LSGM) solid oxide fuel cell electrolyte material research; Dr. Bryan Eigenbrodt, Villanova University
- Collaborated with Dr. Carlo U. Segre as an invited scientist at Argonne National Laboratory's Advanced Photon Source to study *in-situ* redox processes in solid oxide fuel cell anode materials.
    - Supervised sample preparation, data collection and equipment functionality
    - Trained and certified to operate MRCAT 10-ID beamline hardware and software
  - Pioneered lanthanum doped ceria material colloidal ink employed in fuel cell synthesis
  - Established high proficiency in solid state and solution gel synthesis methods
  - Obtained extensive knowledge of X-ray powder diffraction, dielectric spectroscopy, scanning electron microscopy, atomic absorption spectrophotometry and linear sweep voltammetry
  - Awarded research and travel funding through a competitive grant proposal from Villanova Undergraduate Research Fellows
- 04/2013-09/2013 **Undergraduate Researcher:** Iron (III) oxide and zinc oxide nanoparticle ligand exchange research; Dr. Temer Ahmadi, Villanova University
- Assisted in developing various ligand exchange syntheses and instrumentation procedures
  - Performed material analysis using transmission electron microscopy, thermogravimetric analysis, differential scanning calorimetry and fluorescence spectroscopy

## Education

- 08/2016- **Ph.D. in Physical Chemistry:** Temple University, Philadelphia PA, USA
- GPA 3.60/4.00
- 08/2012-12/2015 **Bachelor of Science in Chemistry:** Villanova University, Villanova PA, USA
- Minor in Mathematics
  - GPA 3.59/4.00
- 08/2008-06/2012 **High School:** Boyertown Area Senior High School, Boyertown PA, USA
- GPA: 4.00/4.00

## Awards and Recognitions

1. Inaugurated into Gamma Sigma Epsilon Chemistry Honor Society
2. Three time recipient of W. W. Smith Charitable Trust scholarship
3. Two time recipient of Villanova University Chemistry Department Summer Research Fellowship
4. Recipient of the highly competitive Villanova University Undergraduate Research Fellowship

## Publications

1. Li, H., **Marshall T.**, Aulin, Y., Thenuwara, A., Zhao, Y., Borguet, E., Strongin, D., Ren, F., “Structure and Electrical Properties of Metal Ion Doped Polydopamine (PDA)”, *Journal of Materials Science*, **2018**, 54(8), 6393-6400, DOI: 10.1007/s10853-019-03337-7
2. McKendry, I.G., Mohamad, L.J., Thenuwara, A.C., **Marshall, T.**, Borguet, E., Strongin, D.R., Zdilla, M.J., “Synergistic In-Layer Cobalt Doping and Interlayer Iron Intercalation into Layered MnO<sub>2</sub> Produces an Efficient Water Oxidation Electrocatalyst” *ACS Energy Letters*, **2018**, 3(9), 2280-2285, DOI: 10.1021/acsenerylett.8b01217
3. Piontek S.M., Tuladhar A., **Marshall T.**, Borguet E., “The Influence of Monovalent and Divalent Cations on Interfacial Solvent Ordering and Vibrational Dynamics at the  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>(0001)/Water Interface” *Manuscript in Progress*
4. D’Orazio, A., **Marshall, T.**, Sultana, T., Gerardi, J., Eigenbrodt, B., “High Temperature X-Ray Absorption Spectroscopy of the Local Electronic Structure and Oxide Vacancy Formation in Sr<sub>2</sub>Fe<sub>1.5</sub>Mo<sub>0.5</sub>O<sub>6- $\delta$</sub>  Solid Oxide Fuel Cell Anode Catalyst”, *Journal of the American Chemical Society*, **Submitted 2018**

## Talks

1. Research speaker at 2018 Chautauqua on Nonlinear Optics, “Vibrational Sum Frequency Spectroscopy of Oxide/Aqueous Interfaces”, Purdue University Chemistry Department, West Lafayette IN, USA 2018
2. Speaker at Chemical Safety Panel and Demonstration during Villanova University Safety Day sponsored by Villanova University Chemistry, Biochemistry and Chemical Engineering, Villanova PA, USA 2015
3. Research speaker for Professional Development Seminar course at the Villanova University Chemistry Department, Villanova PA, USA 2015

## Poster Presentations

1. **Marshall T.**, Piontek, S.M., Borguet E., “Impact of Small Ions on Water structure at Alumina/Water Interface using Vibrational Sum Frequency Spectroscopy”, ACS YCC Philadelphia 2017, Philadelphia PA, USA 2018
2. **Marshall T.**, Aulin Y., Gilroy K., Neretina S., Borguet E., “Second Harmonic Generation Spectroscopy of Substrate-Based Surfactant Free Gold and Silver Nano-Hemispheres”, ACS YCC Philadelphia 2017, Philadelphia PA, USA 2017
3. **Marshall T.**, Gilroy K., Neretina S., Borguet E., “Second Harmonic Generation Spectroscopy of Substrate-Based Surfactant Free Gold and Silver Nano-Hemispheres”, ACS Fall 2017 Meeting, Washington DC, USA 2017
4. **Marshall T.**, Eigenbrodt B., “Electrochemical Performance of La<sub>0.80</sub>Sr<sub>0.20</sub>Ga<sub>0.80</sub>Mg<sub>0.20</sub>O<sub>3- $\delta$</sub>  Solid Oxide Fuel Cell Electrolyte Material” Villanova Undergraduate Research Symposium, Villanova PA, USA 2015
5. **Marshall T.**, Eigenbrodt B., “Investigation of La<sub>0.80</sub>Sr<sub>0.20</sub>Ga<sub>0.80</sub>Mg<sub>0.20</sub>O<sub>3- $\delta$</sub>  Solid Oxide Fuel Cell Electrolyte Material Synthesis Routes” Villanova Undergraduate Research Symposium, Villanova PA, USA 2014
6. **Marshall T.**, Ahmadi T., “Surface-Group Substitution of Oleylamine-capped Iron Oxide Nanoparticles”, Villanova Undergraduate Research Symposium, Villanova PA, USA 2013

## Contributed Presentations

1. Eigenbrodt B., Sultana T., D’Orazio A., **Marshall T.**, Gerardi J., “High Temperature X-Ray Absorption Spectroscopic Investigation of Sr<sub>2</sub>Fe<sub>1.5</sub>Mo<sub>0.5</sub>O<sub>6- $\delta$</sub>  Solid Oxide Fuel Cell Electrodes”, 249th ACS National Meeting, Denver CO, USA 2015