YUNQIAN (JOY) ZOU

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SKILLS

Experimental Operations:

- Sum Frequency Generation (SFG) Spectroscopy
- Second Harmonic Generation (SHG) Spectroscopy
- IR pump/vSFG probe dynamic experiments
- Raman Spectroscopy
- Infrared Spectroscopy
- Interferometry 3D profile imaging
- Laser-induced breakdown spectroscopy
- Static & dynamic contact angle measurements
- Glove Box
- Laser spectroscope 3D profile imaging
- Transmission electron microscopy (TEM)
- Gas chromatography Mass spectrometry (GCMS)
- Tandem Mass spectrometry
- X-ray diffraction
- Atomic absorption spectroscopy

Instruments operation, troubleshooting and maintenance:

- Ultrafast Ti:Sapphire Amplifier: Coherent Libra
- Collinear Optical Parametric Amplifier (OPA): Light Conversion TOPAS Prime
- Dual-beam and Single-beam UV/vis, NIR
- Hydrophilic Interaction Chromatography (HILIC) column packing and cleaning
- Waters™ Arc HPLC system

Software: Igor Pro, OriginLab, LabVIEW, ImageJ, MATLAB, Python, Spartan, Gaussian 09, WebMO, ChemDraw, Rhino, Fusion 360

WORK EXPERIENCE

Corning Incorporated, Sullivan Park, Painted Post, NY **Jun 2023 – Aug 2023**

Chemistry Summer Intern

Supervisor: Ryan Rooney

- Lithium and proton elemental detection and quantification using laser-induced breakdown spectroscopy

for lithium lanthanum zirconium oxide (LLZO) solid-state electrolyte of lithium-based battery
- Thermal-induced phase and volumetric changes in ZrO_2 ferrules for optical fibers connection characterized by Raman spectroscopy
- Carbon fiber coating on glass defects and phase structure characterization using Raman spectroscopy

Ph.D. RESEARCH SUMMARY

Acquire the charge distribution, molecules orientation and vibrational lifetime, and H-bonding networks at interface using surface sensitive techniques: sum frequency generation (SFG), second harmonic generation (SHG), and static and dynamic contact angle measurements. Utilizing vibrational spectroscopies to probe the organization of confined water in between layered materials.

EDUCATION

Temple University, Philadelphia, PA **Dec 2020-present**

Ph.D. in Chemistry

Advisor: Prof. Eric Borguet, Dept. of Chemistry

Areas of Concentration: Water dynamics, ions distribution, and organic matters at mineral/water interfaces, interface interactions and hydrogen-bonding structure in confinement, wettability of mineral surfaces

Research Topic: Investigating ultrafast dynamics of water orientation, hydrogen-bond formation and breaking, and molecules accumulation at aqueous/solid interfaces using 2nd order nonlinear spectroscopic techniques: sum frequency generation (SFG) and second harmonic generation (SHG)

Ball State University, Muncie, IN **2018-2020**

M.Sc. in Chemistry

Advisor: Prof. Tykhon Zubkov, Dept. of Chemistry

Areas of Concentration: Synthesizing shape-specific metallic nanoparticles, photo-depositing noble metals on semiconductor catalyst, synthesizing shape-specific nanoparticles on semiconductor by chemical reduction, analyzing photocatalytic reaction products

Thesis: *Manipulating Semiconductor-mediated Photocatalysis by Controlling the Morphology of Metal Cocatalyst in Ag/TiO_2 Nanocomposite*

Purdue University, West Lafayette, IN **2014-2018**

B.Sc. in Chemistry (ACS Certified), Minor in Biology

Advisors: Prof. Mary Wirth & Prof. Hilkka Kenttämaa, Dept. of Chemistry

Area of Study: Chromatography for proteins separation, improving the stationary phase of chromatography column, mass spectroscopy for asphalt residues from petroleum analysis

RESEARCH EXPERIENCE

Department of Chemistry, Temple University – Philadelphia, PA

Graduate Researcher, Laboratory of Prof. Eric Borguet **2020-present**

- Explored the microscopic driving force of water wetting at the mineral surface (Al_2O_3) and discovered the surface wetting is determined by the strength of interfacial H-bonds. A more hydrophilic surface

forms more water-to-surface strong H-bonds than surface-to-water weak H-bonds.

- Detect the vibrational density of states (VDOS) of interfacial specie by measuring the vibrational lifetime of the probe solute molecule (i.e., SCN^-). The coupling between the probe molecule and the interfacial specie creates a more efficient pathway for solute and solvent vibrational energy transfer. The coupling efficiency is determined by the density of available states of the interfacial specie and is directly reflected by the vibrational lifetime of the solute molecule
- Investigate the formation of surface hydroxyl at CaF_2 surface in aqueous environment as functions of pH and ionic strength by performing time and phase resolved SFG spectroscopy and contact angle measurements
- Probe the source of SFG signal of centrosymmetric molecule, N_3^-, at interface, to clarify the contribution to 2nd order nonlinear susceptibility, χ^2, from the bulk and the interface
- Propose vibrational spectroscopic experiments to study the effect of electrostatics induced by the H-bonding structure of confined water on their dielectric response between graphene bilayers
- Mentor undergraduate research: pretreatment for ultra-clean surface, build-up homemade goniometer for sessile-drop and needle-in-drop contact angle measurements, posters and slides presentations guidance

Department of Chemistry, Ball State University – Muncie, IN

Graduate Researcher, Laboratory of Prof. Tykhon Zubkov **2018-2020**

- Synthesized shape-specific Ag nanoparticle with closed-packed (111) surface on TiO_2 nanoparticle
- Operated X-ray Diffraction (XRD) to identify the crystal structure of metal oxides
- Operated Flame Atomic Absorption Spectroscopy (AAS) to quantify the elements in metal oxides
- Characterized the size and structure of nanoparticles using Transmission Electron Microscopy (TEM)
- Evaluated the photocatalytic behavior of Ag (111)/TiO_2 for selective reduction of *m*-dinitrobenzene to *m*-nitroaniline and *m*-phenylenediamine

Department of Chemistry, Purdue University – West Lafayette, IN

Undergraduate Researcher, Laboratory of Prof. Mary Wirth **2017-2018**

- Prepared Hydrophilic interaction liquid chromatography (HILIC) column by Activator Generation Electron Transfer-Atom Transfer Radical Polymerization (AGET ATRP) reaction
- Applied high performance liquid chromatography (**HPLC**) on High Pressure Liquid Chromatography (HPLC) system for protein separation
- Conducted experiment of IgG digestion using Ides enzyme and DTT reduction
- Conducted experiment of Ribonuclease B digestion in 1% of ATP aqueous solution

Department of Chemistry, Purdue University – West Lafayette, IN

Undergraduate Research, Laboratory of Prof. Hilkka Kenttämaa **2016-2017**

- Synthesized organic molecules in archipelago or island structure using Negishi Coupling
- Identified the organic molecules in asphaltene using Tandem mass spectroscopy

Department of Chemistry, Purdue University – West Lafayette, IN

Undergraduate Research, Aston Lab **Spring 2017**

- Applied Desorption Electrospray Ionization (DESI) to mass spectroscopy for isocitrate-dehydrogenase

mutation detection

PUBLICATION

Wang, R.; **Zou, Y.**; Remsing, R. C.; Ross, N. O.; Klein, M. L.; Carnevale, V.; Borguet, E. Superhydrophilicity of α-Alumina Surfaces Results from Tight Binding of Interfacial Waters to Specific Aluminols. *Journal of Colloid and Interface Science* **2022**. *628*, 934-953. DOI: https://doi.org/10.1016/j.jcis.2022.07.164.

Zou, Y.; Ross, N.; Borguet, E. A Simplified Approach for Dynamic Contact Angle Measurements. *Journal of Chemical Education* **2023**. To be submitted.

CONFERENCE PRESENTATIONS

Zou, Y.; Eftekhari-Bafrooei. A.; Borguet, E. Understanding the pH dependence of hydroxyls stretch at CaF_2/H_2O interfaces, 2022 Gordon Research Seminar: Water and Aqueous Solutions, Holderness, NH, July 2022

Zou, Y.; Mandal, B.; Dadashi, S.; DelloStritto, M.; Borguet, E. The dynamics of solutes modulated by the interface solvent density of states, 2022 Gordon Research Conference: Water and Aqueous Solutions, Holderness, NH, July 2022

Zou, Y.; Mandal, B.; Dadashi, S.; DelloStritto, M.; Borguet, E. Probing the vibrational density of states (VDOS) at oxide-aqueous interfaces, ACS National Meeting, San Diego, CA, March 2022

Zou, Y.; Borguet, E. Understanding the H-Bonding Environment at Mineral Oxide/Water Interfaces using IR Pump-vSFG Probe Experiments, 16th Annual Chautauqua on Nonlinear Optics, Purdue University, IN, July 2021.

Zou, Y.; Zubkov,T. Photocatalysis by Ag/TiO_2 Metal-Semiconductor Composite Prepared by Photodeposition and Chemical Reduction of Ag, 68th Midwestern Universities Analytical Chemistry Conference, Indianapolis, IN, November 2019.

Zou, Y.; Wirth, M. Testing A New AGET ATRP Initiator for Production of HILIC Stationary Phases, ACS 2nd Annual East Central Illinois Local Section Undergraduate Research Conference, University of Illinois at Urbana-Champaign, IL, October 2017.

TEACHING EXPERIENCE

Department of Chemistry, Temple University – Philadelphia, PA
Teaching Assistant of General Chemistry **2020-2021**

- Chemistry laboratory class teaching: reviewed teaching contents and lab practice questions
- Monitored lab safety and provided instructional guidance of experiment operation in class
- Graded the pre-lab calculation, experimental procedure design, and lab report for undergraduates

Department of Chemistry, Ball State University – Muncie, IN
Teaching Assistant of General Chemistry and Physical Chemistry **2018-2020**

- Taught students how to run simple simulations using Gaussian 09 helping them to understand reaction pathways, chemical bonds formation & breaking, and orbital hybridization
- Organized help-sessions to answer students' questions before exams
- Reviewed teaching contents, edited lecture slides, and graded students' assignments & exams

VOLUNTEERING AND SERVICE

Temple University International Advisory Board Member, Philadelphia, PA **2022-2023**
Organized: International students welcoming week, Philadelphia city tour, international student peer to peer supports & cultural exchanges

George Washington Carver Science Fair, Philadelphia, PA **Spring 2022**
Evaluated posters presentations and provided motivational feedbacks of science research for local juniors

3D Prototyping & Green Prototyping Upcycle, Ball State University, Muncie, IN **Fall 2019**
Recycled post-consumer high density polyethylene (HDPE) bottle caps to reproduce 3D printing filament

PROFESSIONAL AFFILIATIONS

American Chemical Society (ACS)	2020-present
American Physical Society (APS)	2021-present
The Electrochemical Society (ECS)	2021-present
Optics & Photonics	2023-present