Mykyta Dementyev

PhD Candidate

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Interest Statement

Expert in synthesis and advanced characterization of polymer composites with hands-on experience analyzing materials through structure-property relationships and statistical methods. Leader of multiple successful research projects that focused on materials analysis and development. I am pursuing an industrial position that is focused on the design and optimization of functional materials.

Education

2022 - 2025 **Pennsylvania State University** PhD in Materials Science & Engineering | Advisor: Dr. Robert Hickey
2020 - 2022 **University of California Davis** BS in Physics and a Chemistry Minor | Advisor: Dr. Dong Yu

Core Skills

- Organic and inorganic solid-state syntheses and preparation: Polymer materials (RAFT and free radical) of freestanding films and gels, polymer grafting, gold nanoparticles, methylammonium-based perovskites, and lithium niobate
- Polymer Characterization: Mechanical testing, Differential Scanning Calorimetry (DSC), Thermal Gravimetric Analysis (TGA), Size Exclusion Chromatography (SEC), Nuclear Magnetic Resonance (NMR), UV-Vis, Fourier-Transform Infrared spectroscopy (FT-IR), Raman, Small and Wide-Angle X-ray Scattering (SAXS and WAXS)
- Advanced characterization: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), X-ray Diffraction (XRD), Dynamic Light Scattering (DLS), Atomic Force Microscopy (AFM), Light Profilometry
- Python, R, C++, IGOR Pro, Origin, Mathematica, Adobe Illustrator, and ChemDraw software for effective data processing, statistical analysis, and visualization
- AI assistance for automation and enhancement of productivity and documentation

Research Experience

Aug. 2022 – Present **Pennsylvania State University | Graduate Researcher**

Thesis title: Chemical and Processing Effects on Optical Properties of Polymer/Inorganic Nanocomposite Systems

- Investigated non-linear optical systems in polymer composite materials for applications in communications and data processing through optical phenomena. Focused on inorganic nanofiller incorporation into thermoplastics through mold processing for superior properties. Characterization techniques: TEM, SEM, FT-IR, XRD, SAXS, DLS, TGA, DSC, and NMR.
- Secured **96 hours** of beamtime at NSLS-II source at **Brookhaven National Laboratory** for 2024-2025 cycle.
- Established a guided method for maximizing particle uptake in polymer gels through thermodynamic processes for applications in optics through mechanical stimuli, with functional applications in coatings and adhesives. Skills used: bulk photosynthesis, TEM, UV-Vis, SAXS, WAXS, and rheology.
- Explored the enhanced photoluminescence properties of semiconducting perovskite/polymer composite materials for applications in coatings, dyes, detectors, and thin-films. Skills used: crystal synthesis, plasma treatment, XRD, FT-IR, TEM, and fluorimetry.
- **Designed crucial Safety Operating Procedures (SOPs)** for safe laboratory practices in collaboration with the Penn State Environmental Health and Safety Department.

Mar. 2021 – June 2022 **University of California, Davis | Student Researcher**

- Collected and analyzed photo-responsive data from novel perovskite micro-crystals by performing Scanning Photocurrent Microscopy to study the Circular Photogalvanic Effect crucial for understanding and **development of electronics and photonics of semiconductors** through statistical and numerical methods.
- Modified the **synthesis, fabrication, and characterization** procedures to change the doping in various perovskite microcrystals, such as $MAPbBr_3$, $MAPbI_3$, $FAPbBr_3$, and $CsPbBr_3$.
- Instructed over 100 students in science, mathematics, and statistics classes as a supplemental instructor at the STEM Pathways program and at the Office of Special Services.

Leadership & Outreach Experience

- **Organized educational seminars** for multiple research groups on data analysis of scattering data and **effective data visualization and design**.
- Mentored and co-advised graduate and undergraduate students on multiple **interdisciplinary projects**, resulting in 3 separate research posters and 2 manuscripts.
- Active core member as an ambassador for the Department of Materials Science and Engineering at Penn State. Organized and modified schedules for upcoming scholars and visitors to the department.

Publications

- Waugaman, S.;† **Dementyev, M.**;† Abbasi GharehTapeh, E.; Lopez, C.; Mathers, R.; and Hickey, R. Nanoparticle Loading in Swollen Polymer Gels: An Unexpected Thermodynamic Twist. *Nano Letters*, **2025**, DOI: 10.1021/acs.nanolett.4c06501
- **Dementyev, M.**; Jones, L.; Brennan, M.; Grusenmeyer, T.; Waugaman, S.; Mathers, T.; and Hickey, R. Polymer Macroligands Passivate Halide Perovskite Surfaces. *RSC Appl. Polym.*, **2024**, 2, 857-869. DOI: 10.1039/D4LP00114A
- Laeini, M.; Huang., Z; Guanchun, R.; **Dementyev, M.**; Perini, S.; Vogt, B.; Zhang, Q.; Colby, R.; Hickey, R. Boosting Discharge Energy Density of Commercially Available Polyethylene via Post Polymerization Modification. *Under Review in Macromolecules*, **2025**.
- **Dementyev, M.**; Sarker, S.; Laeini, M.; Gopalan, V.; Hickey, R. Nanoscale Effects on Nonlinear Optical Properties of Polymer Grafted Lithium Niobate Composites. *In Preparation*, **2025**.
- Laeini, M.; Favaz, M.; Goel, S.; **Dementyev, M.**; Lloyd, E.; Vogt, B.; Hickey, R. Boosting Discharge Energy Density of Commercially Available Polyethylene via Post Polymerization Modification. *In Preparation*, **2025**.
- Sabaratne, K; Stivall, B.; Halanayake, K.; **Dementyev, M.**; Countinho de Carvalho, T.; Hickey, D.; Maria, J.P., Hickey, R. Preceramic Polymer-Grafted Nanoparticles: Correlating Synthesis, Microstructure, and Ceramic Conversion, *In Preparation*, **2025**.

Proposals

- Goel, S.;† Dementyev, M.;† Hickey, R. Controlling Polymer Phase Separation and Nanoscale Self-Assembly via Binding-Induced Polarization. **Accepted proposal** for scattering experiments with secured **96 hours** of beamtime at NSLS-II source at Brookhaven National Laboratory for 2024-2025 cycle.

† Indicates equal contribution to the work

Achievements & Fellowships

- Distinguished Student Award, Global Physics Summit, APS in **2025**
- Best Poster Award at Mid-Atlantic Regional Meeting, American Chemical Society at Penn State in **2024**
- Arkema Fellowship for graduate studies, Penn State in **2022 - 2023**
- Outstanding Performance Citation from the Physics and Astronomy department at UC Davis in **2022**
- Fellowship for outstanding transfer students at UC Davis in the amount of **$10,000** in **2020 - 2021**
- Contributed to a team that secured **1st place** at the American Mathematical Association of Two-Year Colleges (AMATYC) national math competition in **2019** and **2020**

Conference Presentations

March 2025 **Global Physics Summit, American Physical Society | Anaheim, CA**

Second Harmonic Generation in Nanocomposite Materials

Poster Presentations

November 2024 **Centennial Celebration of Central PA Chemistry ACS | Pennsylvania State University**

Polymer Macroligands Passivate Perovskite Surfaces

June 2024 **Mid-Atlantic Regional ACS | Pennsylvania State University**

Polymer Macroligands Passivate Perovskite Surfaces

Aug. 2021 **Annual Molecular Foundry Nanoscience Conference | UC Berkley - Virtual**

Long Distance Exciton Transport in Single Crystal Methylammonium Lead Bromide ($MAPbBr_3$) Perovskite Nanoribbons

References

- Dr. Robert J. Hickey, Associate Professor of Materials Science and Engineering at **Penn State**. Email: rjh64@psu.edu
- Dr. Shubhra Goel, Postdoctoral Scholar at **Penn State**. Email: sxg5941@psu.edu
- Dr. Elisabeth Lloyd, Advanced Applications Research Scientist at **Eastman Chemical Company**. elisabethlloydis@gmail.com
- Dr. Robert T. Mathers, Professor of Chemistry at **Penn State New Kensington**. Email: rtm11@psu.edu