Emil I. Jaffal

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Education

City University of New York, The Graduate Center — Expected 2028
Ph.D., Chemistry
Advisor: Dr. Anton Oliynyk

Fordham University, Fordham College at Rose Hill — Aug 2019 – May 2023
B.Sc., Chemistry

Research Experience

Ph.D. Student — *New York, NY*
City University of New York, Hunter College — Jul 2024 – Present

Solid-State Laboratory – Dr. Anton Oliynyk

- Conducting exploratory syntheses of novel intermetallic materials with corresponding analyses using powder X-ray diffraction and scanning electron microscopy.
- Enhancing machine learning applications to predict properties of various binary and ternary compounds, focusing on improving interpretability and predictive capabilities of models in solid-state materials by incorporating detailed structural information.
- Directly mentoring a handful of students, providing guidance in their research projects with both experimental and computational techniques.

Undergraduate Researcher — *Bronx, NY*
Fordham University — Sep 2021 – May 2023

Organic/Materials Laboratory – Dr. Julia Schneider

- Steered materials research involving various reactions as part of a novel multi-step synthesis to create organic semiconductors (OSCs) with tunable conjugated heterocycles to improve conductivity.
- Instrumentation experience includes handling UV-Vis, NMR, fluorescence, and IR spectroscopy with respective machinery and analytic interpretations. General synthesis and purification skills include distillations, extractions, filtrations, and recrystallizations.

Computational Laboratory – Dr. Joshua Schrier

- Identified probable transition states of novel syntheses as part of an NSF-funded collaboration within the chemistry department.
- Performed numerous Gaussian ab initio calculations of internal energies, electronic structures, and geometric data using density functional theory to analyze reaction thermodynamics and predict isomer formations of OSCs.

Professional Experience

Research Chemist — *Tarrytown, NY*
ICL Industrial Products — Sep 2023 – Jul 2024

- Developed novel flame retardant (FR) blends for polyurethane foams in collaboration with external manufacturers and customers, ensuring compliance with international safety regulations.
- Pioneered the integration of polyurethane for battery encapsulation, contributing to advancements in sustainable and high-performance materials, leading to a patent application.
- Led application efforts for VeriQuel® F series, a proprietary phosphorus-based FR for flexible foams,

conducting iterative testing with customers and scaling toll production for MT quantities, with early sales reaching $800K.

- Executed laboratory experiments, standardized flammability tests, and physical property assessments to support new product development and market-driven innovations in halogenated and non-halogenated FRs.

Publications

Improving Mechanical Properties Through Defect Chemistry in Hard Material Ta_3P. *In preparation.* July 2025

Jaffal E.I., Shiryaev D., Selvaratnam B. & Oliynyk A.O.

Quaternary Germanide Structures and Their Properties. *In preparation.* July 2025

Pozdnyakova N., **Jaffal E.I.**, ... & Oliynyk A.O.

Explainable Recommendation Engines to Predict Complex Intermetallics: Synthesis and Characterization of $Gd_{10}RuCd_3$, a Neutron Absorption Material. *In revision, J. Am. Chem. Soc.* July 2025

Xhabrahimi B., **Jaffal E.I.**, ... & Oliynyk A.O.

Dataset of Prototype Structures Adopted by Intermetallic Compounds with AB Stacking. *Preprint submitted to Data Brief.* June 2025

Selvaratnam B., **Jaffal E.I.**, Shiryaev D. & Oliynyk A.O.

Exploring Feature Engineering for Crystal Structure Classification: Interactive Applications of PCA and PLS-DA Clustering. *In revision, J. Chem. Ed.* June 2025

Shiryaev D., **Jaffal E.I.**, Selvaratnam B., Sun Y. & Oliynyk A.O.

Materials Informatics Tools to Analyze Crystal Structures: Crystal Structure of the Novel Ternary Indide $ErCo_2In$. *Integr. Mater. Manuf. Innov.* June 2025

Tyvanchuk Y., Lee S., ..., **Jaffal E.I.**, Selvaratnam B. & Oliynyk A.O.

Unsupervised ML Prediction of Novel 1:3 Intermetallic with Synthesis of $TbIr_3$ ($PuNi_3$-type) as Experimental Validation. *J. Am. Chem. Soc.* Feb 2025

Sethi S.S., Dutta A., **Jaffal E.I.**, ... & Oliynyk A.O.

Composition and Structure Analyzer/Featurizer for Explainable ML Models to Predict Solid State Structures. *Digit. Discov.* Jan 2025

Jaffal E.I., ... & Oliynyk A.O.

Synthesis of PyrDi Isomers with Tunable Excimer Formation. *Org. Lett.* Jan 2025

Johnston K., McCostis A., Mikita E., **Jaffal E.** & Schneider J.A.

Guest Lectures

Solid-State Chemistry: *Introduction to Thermoelectrics – Hunter College, NY* May 2025

Courses Taught

General Chemistry Lab (10600) – *Hunter College, NY* Aug 2025 – June 2026

Presentations

Brookhaven Lab Nuclear Chemistry Summer School – *New York, NY* Jul 2025
Using explainable recommendation engines for the discovery of $Gd_{10}RuCd_3$

ACS Mid-Atlantic Regional Meeting – *South Orange, NJ* May 2025
Quaternary Intermetallic Germanides: Structure, Properties, and Potential Applications

Fordham University Jean Dreyfus Lectureship – *Bronx, NY* Apr 2023
The Schneider Lab

Brookhaven Lab Nuclear Chemistry Summer School – *New York, NY* Jul 2024
The Oliynyk Lab

MAPS: Research at Fordham – *Bronx, NY* Nov 2022
Vinyl Azide Cyclization: Where Organic and Computational Chemistry Meet

Posters

North American Solid State Chemistry Conference – *Ames, IA* Jul 2024
Quaternary Intermetallic Germanides: Structure, Properties, and Potential Applications

Hackathons

SSMC-Collaboration Incubator – *Madison, WI* May 2025

Selected participant for national hackathon-style research workshop. Collaborated on the *Rational Design of Thermoelectrics* with an interdisciplinary cohort of PhD students and professors.

Selected Projects

See the full suite of apps on the Oliynyk lab website, both developed myself here.

XRD Comparison & Matching Tools Mar 2025

Contributed to the development and deployment of GUIs, allowing novice users to compare multiple '.xy' files from X-ray diffraction (XRD) data with .cif files. These help identify impurities, match phases, and visualize differences in crystal structure XRD patterns with ease.

Composition Analyzer/Featurizer (CAF) Jun 2024

Developed an interactive Python script that generates chemical compositional features and provides tools for filtering, sorting, and merging data. Aids novice solid-state chemists and materials scientists in generating compositional training data for machine learning models ranging from dozens to tens of thousands of compounds.

Patents

Heat Resistant Semi-Rigid Polyurethane Foams. *Provisional patent #63/680,764*. Aug 2024
Emil Jaffal, Sergei Levchik, Zhihao Chen, Jeffrey Stowell & Munjal Patel.

Honors and Grants

CUNY Certificate of Achievement 2025
Awarded $3,000 in recognition of outstanding success as a first-year student, including the acceptance of my first-author publication during the Fall 2024 semester.

CUNY Science Scholarship 2024

Fordham University Dean's List 2023

NSF Summer Research Funding Grant (DMR-1928882) 2022

Service

Materials Today Physics – *Reviewer*	Aug 2025 – Present
Fordham University Muslim Students Association – *Treasurer*	Sep 2022 – May 2023
Fordham University Arabic Club – *Vice President*	Jan 2022 – Aug 2022
Fordham Undergraduate Research Journal – *Peer Editor*	Sep 2022 – May 2023

Students Mentored

Brook Xhabrahimi (B.Sc. Chemistry, 2025)
Natalia Poznyakova (B.Sc. Chemistry, 2025)
Miriam Ismail (B.Sc. Chemistry, 2025)
Riya Upadhyay (B.A. Human Biology, 2024)
Alex Vtorov (B.Sc. Chemistry, 2025)
Joseph Oziel (The Bronx High School of Science, 2025)
Yujing Sun (The Bronx High School of Science, 2025)
Brandon Lin (The Bronx High School of Science, 2025)

Memberships

Sigma Xi, The Scientific Research Honor Society – *Associate Member*	Mar 2023 – Present

Technical skills

Software: Adobe Illustrator, Bluehill, ChemOffice, Gaussian16, Mathematica, Maestro, Microsoft Suite, Signals Notebook, TopSpin, VASP, WebMO.
Programming & markup languages: Python, Bash, HTML, Wolfram (Mathematica).
Packages: NumPy, SciPy, Scikit-Learn, Pandas, Matplotlib.
Languages: Arabic (native), English (native), Spanish (conversational).