

Abstract

In the period of April 2023 to March 2024, the unit focused on advancing the synthesis and application of pi-conjugated polymers, which are crucial for organic electronics, bioelectronics, and wearable electronics. Key activities included:

1. **Controlled Polymerizations:** The unit worked on developing precise polymeric structures through controlled polymerizations, enabling detailed structure-property relationship studies that were previously unattainable. This included living polymerizations to synthesize semiconducting polymers and the development of synergistic catalysis techniques to improve synthesis efficiency and control.
2. **Mixed ionic electronic conductors:** The unit investigated the impact of varying side chain structures on the performance of organic electrochemical transistors (OECTs). They specifically studied a series of polythiophene homopolymers with ethylene glycol units in their side chains.
3. **Environmental Impact Studies:** A new area of focus was understanding the fate of microplastics in marine environments, reflecting the unit's commitment to addressing broader environmental issues.

1. Group members

As of March 31st 2024

1.1. Current members

- Prof. Christine Luscombe, Professor
- Dr. Baitan Chakraborty, Postdoctoral Scholar
- Dr. Fathy Hassan, Postdoctoral Scholar
- Dr. Wissem Khelifi, Postdoctoral Scholar
- Dr. Samantha Phan, Postdoctoral Scholar
- Dr. Isha Sanskriti, Postdoctoral Scholar
- Dr. Preeti Yadav, Postdoctoral Scholar
- Dr. Yuan-Qiu-Qiang Yi, Postdoctoral Scholar
- Ms. Nadege Bonnet, Technician
- Mr. Abdulrahman Bakry, Rotation Student
- Ms. Makiko Emori, Graduate Student
- Ms. Syeda Bakhtawar Zahra, Graduate Student
- Ms. Nivedha Velmurugan, Graduate Student
- Mr. Tom Tassilo Wilfling, Graduate Student
- Mr. Vadim Samardak, Rotation Student
- Mr. Jonathan Ratmahal, Visiting Research Student
- Ms. Midori Tanahara, Research Administrator

1.2. Alumni

- Ms. Johanna Johansson, Rotation Student
- Mr. Mitsuyuki Oshiro, Rotation Student
- Mr. Shin Sun, Rotation Student

2. Collaborations

- 2.1. Martin Brinkmann (University of Strasbourg)
- 2.2. Lucas Flagg (National Institute of Standards and Technology)
- 2.3. Lyda Harris (University of Washington)
- 2.4. Yunping Huang (UC Boulder)
- 2.5. Christopher McNeill (Monash University)
- 2.6. Jacqueline Padilla-Gamiño (University of Washington)
- 2.7. Lee Richter (National Institute of Standards and Technology)
- 2.8. Chad Risko (University Kentucky)
- 2.9. Alberto Salleo (Stanford University)
- 2.10. Frank Spano (Temple University)
- 2.11. Michael Toney (UC Boulder)
- 2.12. Diego Torrejon (BlackSky)

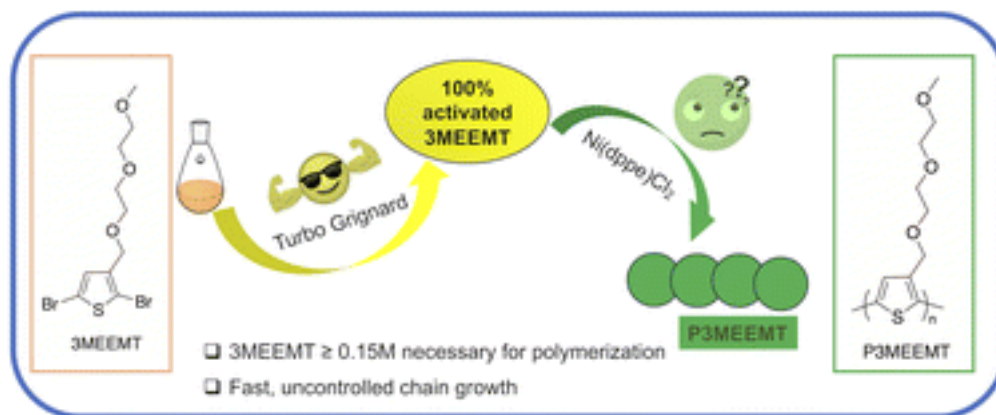
3. Activities and Findings

3.1. Controlled polymerizations

3.1.1. The unexpected fast polymerization during the synthesis of a glycolated polythiophene

Abdulrahman Bakry, Preeti Yadav, Shin-Ya Chen, and Christine K. Luscombe, *Faraday Discuss.*, 2024, **250**, 74-82. DOI: [10.1039/D3FD00146F](https://doi.org/10.1039/D3FD00146F)

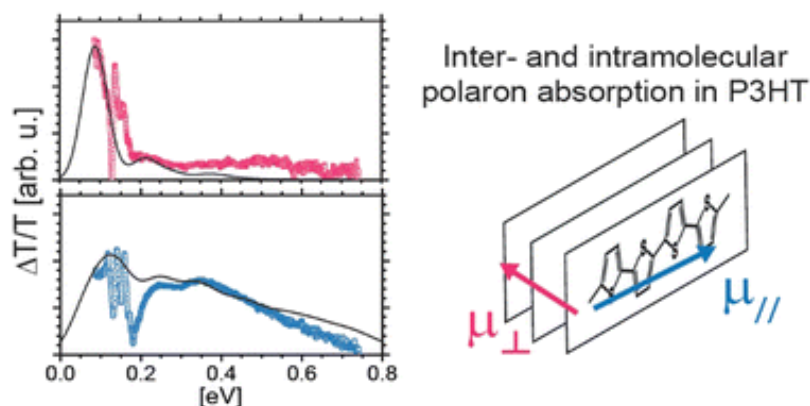
Conjugated polymers with ethylene glycol side chains are emerging as ideal materials for bioelectronics, particularly for application in organic electrochemical transistors (OECTs). To improve the OECT device performance, it is important to develop an efficient synthetic strategy that will provide access to novel high-performing materials besides focusing on molecular design. While a lot of efforts are being devoted to designing of new polymers by modifying the glycol side chains, understanding how their nature affects the polymerization kinetics and eventually the polymer structure and properties is not known. In this work, we have studied the influence of the content of the ethylene glycol side chain and its linkage on the formation of the active Grignard monomer species upon Grignard metathesis in three thiophene derivatives. A strong dependence of the monomer's concentration on polymerization was noted in our study indicating that for synthesizing P3MEEMT, a high-performing OECT material, by Kumada catalyst transfer polymerization (KCTP) a minimum of 0.15 M monomer is needed. Furthermore, kinetic studies by GPC show uncontrolled polymerization behavior contrary to the controlled chain growth characteristics of the KCTP.



3.1.2. Polaron absorption in aligned conjugated polymer films: breakdown of adiabatic treatments and going beyond the conventional mid-gap state model

Garrett LeCroy, Raja Ghosh, Viktoriia Untilova, Lorenzo Guio, Kevin H. Stone, Martin Brinkmann, Christine Luscombe, Frank C. Spano, and Alberto Salleo, *Mater. Horiz.*, 2024, **11**, 545-553. DOI: [10.1039/D3MH01278F](https://doi.org/10.1039/D3MH01278F)

This study provides the first experimental polarized intermolecular and intramolecular optical absorption components of field-induced polarons in regioregular poly(3-hexylthiophene-2,5-diyl), rr-P3HT, a polymer semiconductor. Highly aligned rr-P3HT thin films were prepared by a high temperature shear-alignment process that orients polymer backbones along the shearing direction. rr-P3HT in-plane molecular orientation was measured by electron diffraction, and out-of-plane orientation was measured through series of synchrotron X-ray scattering techniques. Then, with molecular orientation quantified, polarized charge modulation spectroscopy was used to probe mid-IR polaron absorption in the $\hbar\omega = 0.075 - 0.75$ eV range and unambiguously assign intermolecular and intramolecular optical absorption components of hole polarons in rr-P3HT. This data represents the first experimental quantification of these polarized components and allowed long-standing theoretical predictions to be compared to experimental results. The experimental data is discrepant with predictions of polaron absorption based on an adiabatic framework that works under the Born–Oppenheimer approximation, but the data is entirely consistent with a more recent nonadiabatic treatment of absorption based on a modified Holstein Hamiltonian. This nonadiabatic treatment was used to show that both intermolecular and intramolecular polaron coherence break down at length scales significantly smaller than estimated structural coherence in either direction. This strongly suggests that polaron delocalization is fundamentally limited by energetic disorder in rr-P3HT.



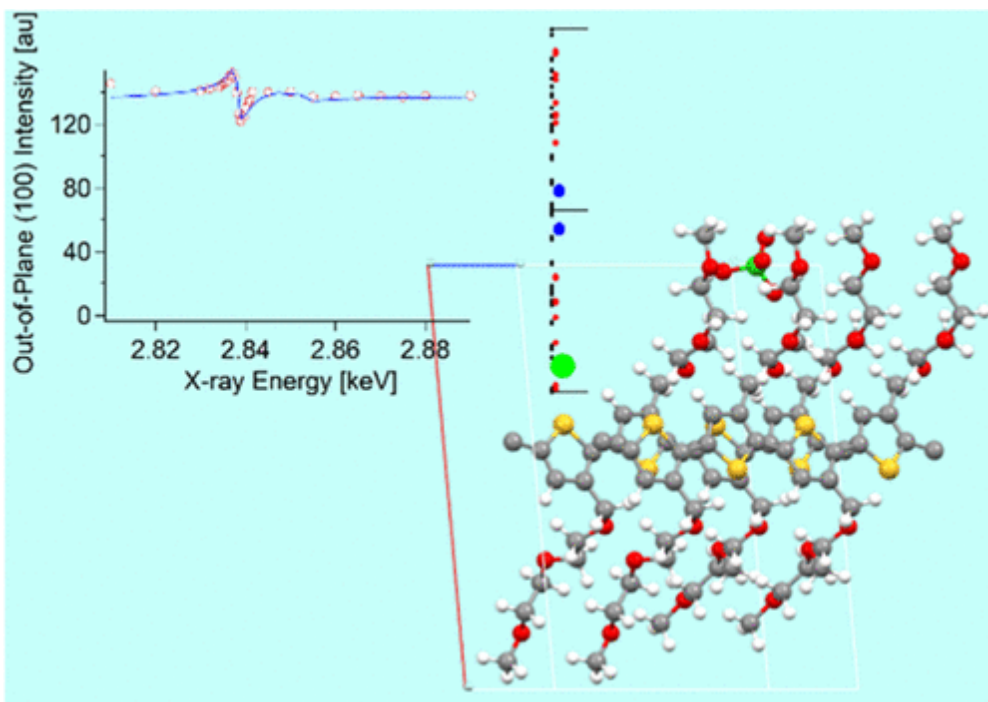
3.2. Mixed ionic electronic conductors

3.2.1. Resonant x-ray diffraction reveals the location of counterions in doped organic mixed ionic conductors

Lucas Q. Flagg, Jonathan W. Onorato, Christine K. Luscombe, Vinayak Bhat, Chad Risko, Ben Levy-Wendt, Michael F. Toney, Christopher R. McNeill, Guillaume Freychet, Mikhail Zhernenkov, Ruipeng Li, and Lee J. Richter *Chem. Mater.*, 2023, **35**, 3960–3967.

DOI: [10.1021/acs.chemmater.3c00180](https://doi.org/10.1021/acs.chemmater.3c00180)

Organic mixed ionic–electronic conductors (OMIECs) have the potential to enable diverse new technologies, ranging from novel in situ biosensors to flexible energy storage devices and neuromorphic computing platforms. However, their complex behavior in functional films involving electrolyte-induced swelling, ion ingress, and electrochemical doping inhibits rational material design. Of critical importance is an understanding of the specific location of the ions in the volumetrically doped material, yet this information is not readily available. In this report, we present the use of grazing-incidence resonant X-ray diffraction (RXRD, also known as anomalous diffraction) at S and Cl K-edges to determine the structure of a doped, prototypical, semicrystalline polymer OMIEC based on oligo(ethylene glycol) substitution of regioregular polythiophene. The RXRD measurement provides two key insights. Quantitative analysis of the RXRD allows the determination of the position of the ion relative to the polymer backbone in the crystalline regions. We find that the anion is relatively distant from the backbone, nearer to the lamella mid-plane naively in conflict with expected Coulombic attraction between the ion and the doped polymer polaron. Comparison of RXRD to Cl[−] fluorescence (total Cl[−]) allows determination of the relative order of doping between the crystalline and amorphous regions. We find preferential doping of the crystalline regions. Both insights, the preferential doping of crystals at low potential and the specific location of the counterion with respect to the polymer backbone, are critical to developing a microscopic understanding of transport in OMIECs.



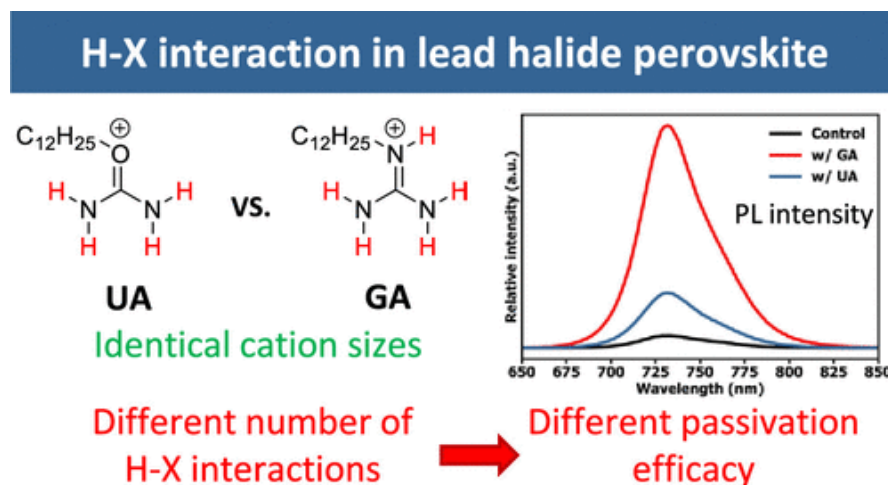
3.2.2. Studying Hydrogen–Halide Interactions in Lead Halide Perovskite with Isoelectronic Cations

Yunping Huang, Yangwei Shi, Theodore A. Cohen, Kevin Ho, and Christine K. Luscombe, *Chem. Mater.* 2023, **35**, 8417–8425.

DOI: [10.1021/acs.chemmater.3c01149](https://doi.org/10.1021/acs.chemmater.3c01149)

A-site cations in lead halide perovskite (LHP) can significantly impact the optoelectronic device efficiency and stability. These efficiency impacts have not been correlated to cation structural features because it is difficult to isolate the independent contributions from the sizes of these A-site cations and hydrogen–halide interaction between the A-site cations and PbX_6 octahedra. To address this, we designed two isoelectronic cationic ligands (guanidinium and uronium) that are nearly identical in size but have different numbers of N–H moieties that can interact with PbX_6 octahedra and studied their differences in passivating LHP solar cell interfaces. While the solar cells showed little improvement after being treated by the alkylated uronium ligand, the alkylated guanidinium ligand increased both the fill factor (from 72.4% to ~80%) and power conversion efficiency (from 15.4% to 17.7%) compared to the untreated device, along with an increased hysteresis index (from 0.02 to 0.12). While the guanidinium-based ligand or uronium-based ligand does not have significant impacts on the morphology of the LHP, the guanidinium-based ligand demonstrated a much more pronounced effect on surface passivation of the $(\text{Cs}_{0.17}\text{FA}_{0.83})\text{Pb}(\text{I}_{0.75}\text{Br}_{0.25})_3$ films (FA = formamidinium). NMR and XRD data together suggested the guanidinium-based ligand interacts with the $(\text{Cs}_{0.17}\text{FA}_{0.83})\text{Pb}(\text{I}_{0.75}\text{Br}_{0.25})_3$ and the CsPbI_3 lattice with 5 H–X interactions,

while the uronium-based ligand interacts with 4 due to the different lattice sizes. Raman spectra indicate that the H–X interaction between the cations and the PbX_6 octahedra alters the electron distribution of the resulting materials. By using a pair of isoelectronic organic cations, we excluded other variables and demonstrated the importance of the hydrogen–halide interactions between cations and PbX_6 octahedra on the surface passivation and optoelectronic properties of the LHP materials.



3.3. Environmental Impact Studies

3.3.1. Exploiting weak supervision to facilitate segmentation, classification, and analysis of microplastics (<100 μm) using Raman microspectroscopy images

Samantha Phan, Diego Torrejon, Jordan Furseth, Erin Mee, and Christine Luscombe *Sci. Total Environ.*, 2023, 886, 163786. DOI: [10.1016/j.scitotenv.2023.163786](https://doi.org/10.1016/j.scitotenv.2023.163786)

Reliable quantification and characterization of [microplastics](#) are necessary for large-scale and long-term monitoring of their behaviors and evolution in the environment. This is especially true in recent times because of the increase in the production and use of plastics during the pandemic. However, because of the myriad of microplastic morphologies, dynamic environmental forces, and time-consuming and expensive methods to characterize microplastics, it is challenging to understand microplastic transport in the environment. This paper describes a novel approach that compares unsupervised, weakly-supervised, and supervised approaches to facilitate segmentation, classification, and the analysis of <100 μm -sized microplastics without the use of pixel-wise human-labeled data. The secondary aim of this work is to provide insight into what can be accomplished when no human annotations are available, using the segmentation and classification tasks as use cases. In particular, the weakly-supervised segmentation performance surpasses the baseline performance set by the unsupervised approach. Consequently, feature extraction (derived from the segmentation results) provides objective parameters describing microplastic morphologies that

will result in better standardization and comparisons of microplastic morphology across future studies. The weakly-supervised performance for microplastic morphology classification (e.g., fiber, spheroid, shard/fragment, irregular) also exceeds the performance of the supervised analogue. Moreover, in contrast to the supervised method, our weakly-supervised approach provides the benefit of pixel-wise detection of microplastic morphology. Pixel-wise detection is used further to improve shape classifications. We also demonstrate a proof-of-concept for distinguishing microplastic particles from non-microplastic particles using verification data from Raman microspectroscopy. As the automation of microplastic monitoring progresses, robust and scalable identification of microplastics based on their morphology may be achievable.

3.3.2. Microparticles in marine mussels at regional and localized scales across the Salish Sea, Washington

Lyda S.T. Harris, Samantha Phan, Diana DiMarco, Jacqueline L. Padilla-Gamiño, Christine Luscombe, and Emily Carrington, *Mar. Pollut. Bull.*, 2023, 196, 115609. DOI: [10.1016/j.marpolbul.2023.115609](https://doi.org/10.1016/j.marpolbul.2023.115609)

Microparticles (MP; particles <5 mm) are ubiquitous in marine environments. Understanding MP concentrations at different spatial scales in the Salish Sea, Washington, **USA**, can provide insight into how ecologically and economically important species may be affected. We collected mussels across the Salish Sea at regional and localized scales, chemically processed tissue to assess MP contamination, and used visual and chemical analyses for particle identification. Throughout the Salish Sea, mussel MP concentrations averaged 0.75 ± 0.09 MP g^{-1} wet tissue. At a regional scale, we identified slight differences in concentrations and **morphotypes** of MP while at a localized scale these metrics were not significant and did not differ from controls. In a subset of particles, 20 % were identified as synthetic materials, which include **polyethylene terephthalate** (PET), **polypropylene** (PP), **polystyrene** (PS), and nylon. Differences in MP sources, heterogeneous transport of MP, and distinct shellfish **feeding mechanisms** may contribute to plastic contamination patterns in the Salish Sea.

4. Publications

4.1. Peer-reviewed publications

- 4.1.1. Lucas Q. Flagg, Jonathan W. Onorato, Christine K. Luscombe, Vinayak Bhat, Chad Risko, Ben Levy-Wendt, Michael F. Toney, Christopher R. McNeill, Guillaume Freychet, Mikhail Zhernenkov, Ruipeng Li, and Lee J. Richter “Resonant x-ray diffraction reveals the location of counterions in doped organic mixed ionic conductors” *Chem. Mater.*, 2023, **35**, 3960-3967. DOI: [10.1021/acs.chemmater.3c00180](https://doi.org/10.1021/acs.chemmater.3c00180)
- 4.1.2. Samantha Phan, Diego Torrejon, Jordan Furseth, Erin Mee, and Christine Luscombe “Exploiting weak supervision to facilitate segmentation, classification,

- and analysis of microplastics (<100 μm) using Raman microspectroscopy images” *Sci. Total Environ.*, 2023, **886**, 163786. DOI: [10.1016/j.scitotenv.2023.163786](https://doi.org/10.1016/j.scitotenv.2023.163786)
- 4.1.3. Yunping Huang, Yangwei Shi, Theodore A. Cohen, Kevin Ho, and Christine K. Luscombe “Studying Hydrogen–Halide Interactions in Lead Halide Perovskite with Isoelectronic Cations” *Chem. Mater.* 2023, **35**, 8417–8425. DOI: [10.1021/acs.chemmater.3c01149](https://doi.org/10.1021/acs.chemmater.3c01149)
- 4.1.4. Lyda S.T. Harris, Samantha Phan, Diana DiMarco, Jacqueline L. Padilla-Gamiño, Christine Luscombe, and Emily Carrington “Microparticles in marine mussels at regional and localized scales across the Salish Sea, Washington” *Mar. Pollut. Bull.*, 2023, **196**, 115609. DOI: [10.1016/j.marpolbul.2023.115609](https://doi.org/10.1016/j.marpolbul.2023.115609)
- 4.1.5. Wissem Khelifi and Christine K. Luscombe “Advances in polymerized small-molecule acceptors for improved performance in all-polymer solar cells” *Chem. Phys. Rev.*, 2023, **4**, 041307. DOI: [10.1063/5.0169728](https://doi.org/10.1063/5.0169728)
- 4.1.6. Abdulrahman Bakry, Preeti Yadav, Shin-Ya Chen, and Christine K. Luscombe “The unexpected fast polymerization during the synthesis of a glycolated polythiophene” *Faraday Discuss.*, 2024, **250**, 74-82. DOI: [10.1039/D3FD00146F](https://doi.org/10.1039/D3FD00146F)
- 4.1.7. Garrett LeCroy, Raja Ghosh, Viktoriia Untilova, Lorenzo Guio, Kevin H. Stone, Martin Brinkmann, Christine Luscombe, Frank C. Spano, and Alberto Salleo “Polaron absorption in aligned conjugated polymer films: breakdown of adiabatic treatments and going beyond the conventional mid-gap state model” *Mater. Horiz.*, 2024, **11**, 545-553. DOI: [10.1039/D3MH01278F](https://doi.org/10.1039/D3MH01278F)

4.2. Non-peer-reviewed publications

- 4.2.1. Catherine M. Aitchison, et al. “Excitonic organic materials for photochemical and optoelectronic applications: general discussion” *Faraday Discuss.*, 2024, **250**, 298-334. DOI: [10.1039/D4FD90008A](https://doi.org/10.1039/D4FD90008A)
- 4.2.2. Catherine M. Aitchison, et al. “Organic neuromorphics and bioelectronics: general discussion” *Faraday Discuss.*, 2024, **250**, 83-95. DOI: [10.1039/D4FD90006E](https://doi.org/10.1039/D4FD90006E)

4.3. Oral and poster presentations

4.3.1. Invited presentations

- 4.3.1.1. Luscombe, C. K. “Controlled synthesis of semiconducting polymers and their applications to synthesize organic mixed ionic/electronic conductors” 14th Advanced Polymers via Macromolecular Engineering, Paris, France, April 2023
- 4.3.1.2. Luscombe, C. K. “Synthesis of semiconducting polymers by polycondensations based on direct arylation and catalyst transfer” 72nd SPSJ Annual Meeting, May 2023
- 4.3.1.3. Luscombe, C. K. “Zwitterion-functionalized Polymers for the Stabilization of Lead Halide Perovskite Nanocrystals” IUMRS-ICAM & ICMAT 2023, Singapore, June 2023
- 4.3.1.4. Luscombe, C. K. “Controlled synthesis of conjugated polymers” 23-1 高分子学会講演会, Tokyo, July 2023

- 4.3.1.5. Luscombe, C. K. "C-H activation of the synthesis of semiconducting polymers" The 13th SPSJ International Polymer Conference, Sapporo, July 2023
- 4.3.1.6. Luscombe, C. K. "Advances in semiconducting polymer synthesis" ACS Science Talk, Virtual presentation, September 2023
- 4.3.1.7. Luscombe, C. K. "The intriguing properties of indacenodithiophene (IDT)-based polymers" Kanto Koubunshi Symposium, Virtual presentation, September 2023
- 4.3.1.8. Luscombe, C. K. "The unexpected fast polymerization during the synthesis of a glycolated polythiophene" Chemical Science Symposium 2023: Chemistry of Polymers, London, UK, October 2023
- 4.3.1.9. Luscombe, C. K. "The unexpected fast polymerization during the synthesis of a glycolated polythiophene" Faraday Discussions 2023, Osaka, November 2023
- 4.3.1.10. Luscombe, C. K. "The unexpected fast polymerization during the synthesis of a glycolated polythiophene" Japan-US Polymer Workshop, Okinawa, November 2023
- 4.3.1.11. Luscombe, C. K. "Towards sustainable methods to synthesize semiconducting polymers" OIST-Kyushu Joint Workshop, February 2024
- 4.3.1.12. Luscombe, C. K. "The unexpected fast polymerization during the synthesis of a glycolated polythiophene" ACS Spring National Meeting, New Orleans, March 2024
- 4.3.1.13. Luscombe, C. K. "Deciphering ionic and electronic motion in mixed ionic/electronic conducting polymers" OIST-UCSB Joint Workshop, March 2024

4.3.2. Plenary Speaker

- 4.3.2.1. Luscombe, C. K. "Towards the efficient of semiconducting polymers" 15th International Symposium on Functional Pi Systems, Raleigh, NC, July 2023
- 4.3.2.2. Luscombe, C. K. "Towards the efficient syntheses of semiconducting polymers" Polymer Meeting 15, Slovakia, September 2023

4.3.3. Seminars

- 4.3.3.1. Luscombe, C. K. "Synergistic approaches to synthesize semiconducting polymers" Department of Chemistry, University of Oxford, April 2023
- 4.3.3.2. Luscombe, C. K. "Towards more efficient syntheses of semiconducting polymers" Kyoto Institute of Technology, July 2023
- 4.3.3.3. Luscombe, C. K. "Making Sense of the Mess" OIST, September 2023
- 4.3.3.4. Luscombe, C. K. "Understanding doping and de-doping in organic mixed ionic-electronic conducting polymers" University of Kyushu, November 2023
- 4.3.3.5. Luscombe, C. K. "Side-Chain Engineering to Balance Ionic and Electronic Conductivities in Mixed Ionic/Electronic Conductors" University of Kyoto, January 2024

4.3.4. Contributed Oral Presentations

- 4.3.4.1. Phan, Samantha; Luscombe, Christine "Weathering effects on microplastic chemical characterization." (Oral): 2023 Advanced Polymers via Macromolecular Engineering, Paris, France; 27 April 2023.
- 4.3.4.2. Chakraborty, B.; Xing, L.; Liu, J.-R.; Hong, X.; Houk, K. N.; Luscombe, C. K. "Accelerated chain extension in cross-dehydrogenative coupling polymerization" ACS Fall 2023, San Francisco, USA, August 2023.
- 4.3.4.3. Sanskriti, Isha; Luscombe, Christine K. "Investigation of Room Temperature C-H functionalization via a Light Mediated Approach" ACS fall 2023, San Francisco, US, August 13-17, 2023.
- 4.3.4.4. Yadav, P; Luscombe C K "Asymmetric Side-Chain Engineering of Thiophene-Based Polymers for Organic Electrochemical Transistor Applications" MRS Fall Meeting, Boston, USA, November 2023.

4.3.5. Poster Presentations

- 4.3.5.1. Hassan, Fathy; Truong, Viet-Giang; Nic Chormaic, Síle; Luscombe, Christine "*Light-Driven Cellulose Nanocrystals Enabled by Photochromic Molecular Switch*" (Poster): 2023 Japan-US Symposia on Polymer Chemistry: Meeting the Challenges of a Sustainable Society with Macromolecules, OIST, Okinawa, Japan; 30 October 2023.
- 4.3.5.2. Yadav, P; Chen, S-Y; Luscombe C K "Impact of Side-chain Structure on Organic Electrochemical Transistor Performance of Glycolated Polythiophenes" Japan-US Seminar on Polymer Chemistry: Meeting the Challenges of a Sustainable Society with Macromolecules, Okinawa, Japan, October 2023.
- 4.3.5.3. Bakry, A.; Yadav, P.; Chen, S-Y; Luscombe, C. K. "Study the Effect of Monomer Concentration and Type of Grignard Reagent on the Polymerization of Glycolated Polythiophene" Poster presentation, Japan-US Seminar on Polymer Chemistry (Meeting the Challenges of a Sustainable Society with Macromolecules), Okinawa, Japan, October 2023.
- 4.3.5.4. Yi, Yuan-Qiu-Qiang; Su, Wenming; Luscombe, K. Christine "*In-situ Photolithographically Cross-linked and Patterned Semiconducting Polymer Film for Light Emitting Diodes*" (Poster): 2023 Japan-US Symposia on Polymer Chemistry: Meeting the Challenges of a Sustainable Society with Macromolecules, OIST, Okinawa, Japan; 30 October 2023.
- 4.3.5.5. Sanskriti, Isha; Mayhugh, Amy L.; Luscombe, Christine K. "Investigation of Room Temperature Direct Arylation via a Light Mediated Approach" Japan-US Seminar on Polymer Chemistry: Meeting the Challenges of a Sustainable Society with Macromolecules, Okinawa, Japan, October 30-November 3, 2023.
- 4.3.5.6. Hassan, Fathy; Truong, Viet-Giang; Nic Chormaic, Síle; Luscombe, Christine "*Light-Driven Molecular Switching Based on Liquid Crystalline Cellulosic Polymers*" (Poster): 10th International Symposium On Photochromism, ISOP 2023, Nara, Japan; 07 November 2023.

- 4.3.5.7. Hassan, Fathy; Truong, Viet-Giang; Nic Chormaic, Síle; Luscombe, Christine "*Bioinspired Photonic Materials from Cellulose and Functionalization by Photochromic Molecular Switch*" (Poster): OIST-Kyudai Joint Symposium Series 1: Bio-Inspired Wonders and Energy Innovations, OIST, Okinawa, Japan; 29 February 2024.
- 4.3.5.8. Velmurugan, Nivedha; Hassan, Fathy; Yamane, Yusuke; Luscombe, Christine; "*One pot C-H arylation and ring closures of benzofurans at room temperature*" OIST-Kyudai Joint Symposium Series 1: Bio-inspired wonders and Energy Innovations. OIST, Okinawa, Japan. February 2024.

5. Other Specific Achievements

SHINKA Award, 2023

Outstanding Reviewer for Energy and Environmental Science, 2023

Outstanding Reviewer for Industrial Materials and Chemicals (RSC), 2023

OIST Students' Choice Teaching Award, 2023

6. Meetings and Events

6.1. [Seminar] "**Organic Ionic-Electronic Mixed Conductors-Based on 3D Bioelectronic Interfaces, Reconfigurable Neuromorphic Circuits, and 3D Neuronal Cell Cultures**" by **Prof. Myung-Han Yoon**

2023-07-27

B503, Lab 1 & Zoom

Prof. Myung-Han Yoon, Gwangju Institute of Science and Technology (GIST)

6.2. [Seminar] "**Conjugated polymers as photocatalysts for solar fuels generation**" by **Dr. Sebastian Sprick, University of Strathclyde**

2023-08-15

L4E48

Dr. Sebastian Sprick, Department of Pure and Applied Chemistry, University of Strathclyde

6.3. [Seminar] "**How to Publish with Impact**" by **Antony Galea, Royal Society of Chemistry (RSC)**

2023-10-30

L4E48

Target Audience: OISTers interested in publishing in the field of chemistry. 40 minutes talk + Q&A.

6.4. [Seminar] "**On the Functional Bioplastics**" by **Prof. Masaru Yoshida, Catalytic Chemistry Research Center, AIST**

2023-11-08

L5D23, Level D, Lab 5

Prof. Masaru Yoshida, Director, Research Center for Integrated Catalysis Chemistry, AIST

6.5. [Seminar] "Using recent Nobel Prize-winning chemistry for biochemical materials" by Prof. Barrett Eichler (Augustana University)

2024-01-19

C016, Lab 1

Seminar by Prof. Barrett Eichler, Augustana University

6.6. 2024 IUPAC Global Women's Breakfast at OIST

2024-02-27

L5D02 (Atrium)

6.7. [Seminar] "Unconventionally low donor content in efficient polymer solar cells and photocatalytic nanoparticles" by Prof. Mats Andersson

2024-04-01

Seminar Room L5D23

Prof. Mats Andersson, Flinders University, Adelaide, SA, Australia

7. Others

7.1. Lecturer

Christine Luscombe was a lecturer at Kyoto Institute of Technology (July 2023) and the University of Kyoto (January 2024).

7.2. SPSJ Diversity

Christine Luscombe gave a talk on diversity at the SPSJ Toronkai (September 2023).

7.3. Outreach

Samantha Phan gave a presentation at the Okinawa Prefectural Library

Phan, Samantha "Microplastics and Us." (Oral): OIST Science Talk. Naha, Okinawa; 20 January 2024.

7.4. C-Hub Inclusive Workshop

Rodrigues, Jamila; Phan, Samantha "Re-structuring, re-connecting, and re-thinking academic research using inclusive communication." 2024 C-Hub Symposium: Inclusive Communication. 7 March 2024.

7.5. Yokohama High School

Christine Luscombe gave a presentation entitled "An introduction to (semiconducting) polymers" to high school students (October 2023).

7.6. Society of Polymer Science Japan

Christine Luscombe is serving as a Board member for SPSJ.

7.7. Materials Research Society

Christine Luscombe is serving on the Board of MRS.

7.8. ACS Macromolecules

Christine Luscombe is serving as Associate Editor for Macromolecules

7.9. Faculty Council

Christine Luscombe is serving as Chair of the Faculty Council

7.10. Editorial Advisory Boards

Christine Luscombe is serving on the Advisory Boards for the following journals: *Polymer Chemistry*, *Chemical Reviews*, *Synthetic Metals*, *ACS Applied Polymer Materials*, *Polymer Journal*, *Advanced Functional Materials*, *Annual Reviews of Materials Research*, *ACS Applied Materials and Interfaces*, *Polymer International*, *Advanced Electronic Materials*

Serving as the Chair of the Advisory Board of *Journal of Applied Physics*