

Exponent®
Engineering & Scientific Consulting

Jon Onorato, Ph.D., P.E.

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Professional Profile

Dr. Onorato's core expertise is at the intersection of materials science, physicochemical structure, and related bulk properties, which he applies to assist clients in a range of industries, including building materials, construction, paints and coatings, consumer electronics, and automotive components. During his tenure at Exponent, Dr. Onorato has led investigations of plastic plumbing components including those made from cross-linked polyethylene (PEX), polypropylene, and chlorinated (CPVC/PVC), paints and coating systems (for example, steel protective coatings and intumescent coatings), and exterior cladding and roofing material systems. Dr. Onorato has also assisted clients with product compliance investigations, product redesign efforts, and intellectual property evaluations.

Leveraging his knowledge of structure-property relationships and his training as a materials scientist, Dr. Onorato is adept at understanding the performance of complex material systems. His expertise also extends to material characterization utilizing testing methods to connect material chemistry and with bulk properties for materials such as plastics, rubbers, adhesives, electronics, optical composites and coatings, and organic thin films. Dr. Onorato is highly experienced in a range of material characterization techniques, including nuclear magnetic resonance, gas chromatography-mass spectrometry, gel-permeation chromatography, matrix-assisted laser desorption/ionization – time of flight, and Fourier transform infrared spectroscopy, and thin-film and bulk techniques including differential scanning calorimetry, thermogravimetric analysis, atomic force microscopy, ellipsometry, X-ray diffraction, and mechanical testing. He has experience fabricating organic thin films using spin-coating, inkjet printing, doctor blading, and electrochemical deposition. He is also proficient in the synthesis of polymers and small molecules, including using reactive and air sensitive techniques.

Prior to joining Exponent, Dr. Onorato was a Senior Organic Chemist at Meta Reality Labs, where he worked with optoelectronic devices in consumer electronics through multiple scales of production, building devices with state-of-the-art optical performance and stability with robust and scalable chemical processes. He also worked extensively with thin films in optical devices, targeting high reliability and UV-stability in liquid optically clear adhesives. As a postdoctoral researcher at the University of Washington, his work centered on crystallinity in organic electronics and developing novel ion and electron conducting polymers, which see application in batteries, organic electrochemical transistors, and organic electrochromics.

Academic Credentials & Professional Honors

Ph.D., Material Science and Engineering, University of Washington, 2020

B.S.E., Polymer Science and Engineering, Case Western Reserve University, 2014

NSF DIRECT Data Science Fellowship (2019)

ACS Polymer Chemistry Division's Excellence in Graduate Polymer Research (2019)

UW Clean Energy Institute Graduate Fellowship (2017)

Licenses and Certifications

Professional Engineer Metallurgical, California, #2065

NACE - Certified Coating Inspector Level 1 Certification

Prior Experience

Senior Organic Chemist, Meta Reality Labs, 2022

Materials Engineer, TEKSystems at Meta Reality Labs, 2021-2022

Postdoctoral Research Associate and Lecturer, University of Washington Materials Science and Engineering Department, 2020-2021

Publications

Flagg, L. Q., Onorato, J. W., Luscombe, C. K., Bhat, V., Risko, C., Levy-Wendt, B., Toney, M. F., McNeill, C. R., Freychet, G., Zhernenkov, M., Li, R., Richter, L. J. Resonant X-ray Diffraction Reveals the Location of Counterions in Doped Organic Mixed Ionic Conductors. Chem. Mater. 35, 3960-3967 (2023).

Sommerville, P. J. W., Balzer, A. H., Lecroy, G., Guio, L., Wang, Y., Onorato, J. W., Kukhta, N. A., Gu, X., Salleo, A., Stingelin, N., Luscombe, C. K. Influence of Side Chain Interdigitation on Strain and Charge Mobility of Planar Indacenodithiophene Copolymers. ACS Polymers Au 3, 59-69 (2022).

Herzing, A. A., Flagg, L. Q., Richter, L. J., Onorato, J. W., Luscombe, C. K. Using 4D-STEM to Track Structural Changes Due to Electrochemical Doping in Organic Electrochemical Transistors. Microscopy and Microanalysis 28, 2256-2257 (2022).

Flagg, L. Q., Asselta, L. E., D'Antona, N., Nicolini, T., Stingelin, N., Onorato, J. W., Luscombe, C. K., Li, R., Richter, L. J. In Situ Studies of the Swelling by and Electrolyte in Electrochemical Doping of Ethylene Glycol-Substituted Polythiophene. ACS Appl. Mater. & Interfaces 14, 29052-29060 (2022).

Chen, S. E., Flagg, L. Q., Onorato, J. W., Richter, L. J., Guo, J., Luscombe, C. K., Ginger, D. S. Impact of Varying Side Chain Structure on Organic Electrochemical Transistor Performance: A Series of Oligoethylene Glycol-Substituted Polythiophenes. J. Mat. Chem. A 10, 10738-10749 (2022).

Dong, B. X., Nowak, C., Onorato, J. W., Ma, T., Niklas, J., Poluektov, O. G., Grocke, G., DiTusa, M. F., Escobedo, F. A., Luscombe, C. K., Nealey, P. F., Patel, S. N. Complex Relationship between Side-Chain Polarity, Conductivity, and Thermal Stability in Molecularly Doped Conjugated Polymers. Chem. Mater. (2021) doi:10.1021/acs.chemmater.0c04153.

Gu, K., Wang, Y., Li, R., Tsai, E., Onorato, J. W., Luscombe, C. K., Priestley, R. D., Loo, Y-L. Role of Postdeposition Thermal Annealing on Intracrystallite and Intercrystallite Structuring and Charge Transport in Poly(3-hexylthiophene). ACS Appl. Mater. Interfaces (2020) doi:10.1021/acsami.0c16676.

Sommerville, P. J. W., Li, Y., Dong, B. X., Zhang, Y., Onorato, J. W., Tatum, W. K., Balzer, A. H., Stingelin, N., Patel, S. N., Nealey, P. F., Luscombe, C. K. Elucidating the Influence of Side-Chain Circular Distribution on the Crack Onset Strain and Hole Mobility of Near-Amorphous Indacenodithiophene Copolymers. Macromolecules 53, 7511–7518 (2020).

Tatum, W. K., Torrejon, D., O'Neil, P., Onorato, J. W., Resing, A. B., Holliday, S., Flagg, L. Q., Ginger, D. S., Luscombe, C. K. Generalizable Framework for Algorithmic Interpretation of Thin Film Morphologies in Scanning Probe Images. J. Chem. Inf. Model. (2020) doi:10.1021/acs.jcim.0c00308.

Herbert, K. M., Getty, P. T., Dolinski, N. D., Hertzog, J. E., de Jong, D., Lettow, J. H., Romulus, J., Onorato, J. W., Foster, E. M., Rowan, S. J. Dynamic Reaction-Induced Phase Separation in Tunable, Adaptive Covalent Networks. Chem. Sci. 11, 5028–5036 (2020).

Bischak, C. G., Flagg, L. Q., Yan, K., Rehman, T., Davies, D. W., Quezada, R. J., Onorato, J. W., Luscombe, C. K., Diao, Y., Li, C.-Z., Ginger, D. S. A Reversible Structural Phase Transition by Electrochemically-Driven Ion Injection into a Conjugated Polymer. J. Am. Chem. Soc. 142, 7434–7442 (2020)

Flagg, L. Q., Bischak, C. G., Quezada, R. J., Onorato, J. W., Luscombe, C. K., Ginger, D. S. P-Type Electrochemical Doping Can Occur by Cation Expulsion in a High-Performing Polymer for Organic Electrochemical Transistors. ACS Mater. Lett. 2, 254–260 (2020).

Gu, K., Onorato, J. W., Luscombe, C. K. & Loo, Y.-L. The Role of Tie Chains on the Mechano-Electrical Properties of Semiconducting Polymer Films. Adv. Electron. Mater. 6, 1901070 (2020).

Pakhnyuk, V., Onorato, J. W., Steiner, E. J., Cohen, T. A. & Luscombe, C. K. Enhanced Miscibility and Strain Resistance of Blended Elastomer/π-conjugated Polymer Composites Through Side Chain Functionalization Towards Stretchable Electronics. Polym. Int. 69, 308–316 (2020).

Flagg, L. Q., Bischak, C. G., Onorato, J. W., Rashid, R. B., Luscombe, C. K., Ginger, D. S. Polymer Crystallinity Controls Water Uptake in Glycol Side-Chain Polymer Organic Electrochemical Transistors. J. Am. Chem. Soc. 141, 4345–4354 (2019).

Onorato, J. W., Dong, B. X., Nowak, C., Strzalka, J., Escobedo, F. A., Luscombe, C. K., Nealey, P. F., Patel, S. N. Influence of Side-Chain Chemistry on Structure and Ionic Conduction Characteristics of Polythiophene Derivatives: A Computational and Experimental Study. Chem. Mater. 31, 1418–1429 (2019).

Onorato, J. W. & Luscombe, C. K. Morphological Effects on Polymeric Mixed Ionic/Electronic Conductors. Mol. Syst. Des. Eng. 4, 310–324 (2019).

Gu, K., Snyder, C. R., Onorato, J., Luscombe, C. K., Bosse, A. W., Loo, Y.-L. Assessing the Huang–Brown Description of Tie Chains for Charge Transport in Conjugated Polymers. ACS Macro Lett. 7, 1333–1338 (2018).

Chew, A. R., Ghosh, R., Pakhnyuk, V., Onorato, J., Davidson, E. C., Segalman, R. A., Luscombe, C. K., Spano, F. C., Salleo, A. Unraveling the Effect of Conformational and Electronic Disorder in the Charge Transport Processes of Semiconducting Polymers. Adv. Funct. Mater. 28, 1804142 (2018).

Li, Y., Tatum, W. K., Onorato, J. W., Zhang, Y. & Luscombe, C. K. Low Elastic Modulus and High Charge Mobility of Low-Crystallinity Indacenodithiophene-Based Semiconducting Polymers for Potential Applications in Stretchable Electronics. Macromolecules 51, 6352–6358 (2018).

Ghosh, R., Chew, A. R., Onorato, J., Pakhnyuk, V., Luscombe, C. K., Salleo, A., Spano, F. C. Spectral Signatures and Spatial Coherence of Bound and Unbound Polarons in P3HT Films: Theory Versus Experiment. J. Phys. Chem. C 122, 18048–18060 (2018).

Gu, K., Onorato, J., Xiao, S. S., Luscombe, C. K. & Loo, Y.-L. Determination of the Molecular Weight of Conjugated Polymers with Diffusion-Ordered NMR Spectroscopy. Chem. Mater. 30, 570–576 (2018).

Scholes, D. T., Yee, P. Y., Lindemuth, J. R., Kang, H., Onorato, J., Ghosh, R., Luscombe, C. K., Spano,

F. C., Tolbert, S. H., Schwartz, B. J. The Effects of Crystallinity on Charge Transport and the Structure of Sequentially Processed F4TCNQ-Doped Conjugated Polymer Films. Adv. Funct. Mater. 27, 1702654 (2017).

Giridharagopal, R., Flagg, L. Q., Harrison, J. S., Ziffer, M. E., Onorato, J., Luscombe, C. K., Ginger, D. S. Electrochemical Strain Microscopy Probes Morphology-Induced Variations in Ion Uptake and Performance in Organic Electrochemical Transistors. Nat. Mater. 16, 737–742 (2017).

Li, Y., Tatum, W. K., Onorato, J. W., Barajas, S. D., Yang, Y. Y., Luscombe, C. K. An Indacenodithiophene-Based Semiconducting Polymer with High Ductility for Stretchable Organic Electronics. Polym. Chem. 8, 5185–5193 (2017).

Onorato, J., Pakhnyuk, V. & Luscombe, C. K. Structure and Design of Polymers for Durable, Stretchable Organic Electronics. Polym. J. 49, 41–60 (2017).

Presentations

Poster: Effects of Polymer Chemistry on Performance of Mixed Conducting Polymer Systems. Onorato, J. W., Dong, B. X., Nowak, C., Strzalka, J., Luscombe, C. K., Escobedo, F. A., Nealey, P. F., Patel, S. N. SCI-STEM 2020. Seattle, WA. Jan. 22, 2020

Talk: Effects of Side-chain Architecture of Polythiophene Derivatives on Structure and Ionic Conduction. Onorato, J. W., Dong, B. X., Nowak, C., Strzalka, J., Luscombe, C. K., Escobedo, F. A., Nealey, P. F., Patel, S. N. ACS POLY Excellence in Graduate Polymer Research. Orlando, FL. Apr. 2, 2019

Poster: Mixed-Ionic Electronic Conductors for Organic Electronics. Onorato, J. W., Luscombe, C. K. ORCAS 2018. Friday Harbor, WA. Sep. 7, 2018.

Talk: Improving Understanding of Mixed Ionic/Electronic Conductors for Novel Electrochemical Applications. Onorato, J. W., Luscombe, C. K. UW MSE Industry Day 2018. Seattle, WA. Oct. 30, 2018.

Improved Durability of Semiconducting Polymers by Self-Healing Chemistry. Onorato, J. W., Luscombe, C. K. UW MSE Industry Day 2016. Seattle, WA. Oct. 24, 2016.

Peer Reviews

Macromolecules