

Patrick F. Murphy, Ph.D., CFEI
Senior Associate

Professional Profile

Dr. Murphy's expertise is in the areas of electrical engineering and electronic circuits, semiconductor devices and integrated circuit fabrication, photonic devices and optical communication. His project experience includes analyzing complex electronic devices, systems, and networks in the course of failure analysis investigations and intellectual property disputes.

At Exponent, Dr. Murphy has worked on projects related to flash memory architecture and fabrication processes, telecommunications networks for IPTV and financial transactions, and reliability issues in consumer electronics. He has assisted clients in technical analyses for patent and trade secret litigation and in conducting prior-art analyses and locating prior-use examples. Dr. Murphy has experience identifying the root cause of failures in consumer electronics and has assisted in investigations to determine the origin and cause of fires. He has conducted exposure assessments per relevant standards for radio-frequency and utility-frequency electromagnetic fields.

Dr. Murphy's Ph.D. research focused on nanolithography for subwavelength optical elements, silicon photonic waveguides, and silicon nanowires. He worked extensively with advanced integrated circuit fabrication techniques such as nanoimprint lithography, holographic lithography, and excimer laser processing. He is proficient in a number of optical and electronic fabrication and characterization techniques. As an intern at Spire Corporation and student researcher at Boston University's Nanophotonics Laboratory, Dr. Murphy worked on design and characterization of photodetectors and solar cells.

Dr. Murphy has seasoned experience teaching electric circuit theory, electronic devices and integrated circuit fabrication, optical spectroscopy and optical communication, and digital logic and computer design. Dr. Murphy currently holds an academic position as Adjunct in the Department of Applied Physics at the Polytechnic Institute of NYU.

Academic Credentials and Professional Honors

Ph.D., Electrical Engineering, Princeton University, 2009
M.A., Electrical Engineering, Princeton University, 2004
B.S., Electrical Engineering, Boston University (*magna cum laude*), 2002

Richard Ralston Hough Award for Distinguished Teaching, Princeton University Department of Electrical Engineering; Graduate Student Teaching Award, Association of Princeton Graduate Alumni; Commendation for Outstanding Teaching, Princeton University School of Engineering and Applied Science; McGraw Graduate Fellow, Princeton University

Licenses and Certifications

Certified Fire and Explosion Investigator (CFEI)
Engineer-in-Training, New Jersey

Academic Appointments

Adjunct Faculty, Department of Applied Physics, Polytechnic Institute of NYU, 2009–present

Publications

Wang C, Murphy PF, Yao N, McIlwrath K, Chou SY. Growth of straight silicon nanowires on amorphous substrates with uniform diameter, length, orientation, and location using nanopatterned host-mediated catalyst. *Nano Letters* 2011; 11:5247.

D'Andrade B, Kattamis AZ, Murphy PF, McNulty J, Souris S. Arcing enabled by tin whiskers. *IEEE: Reliability Society 2010 Annual Technical Report*, 2010.

Liang Y, Murphy PF, Li W, Chou SY. Self-limited self-perfection by liquefaction for sub-20 nm trench/line fabrication. *Nanotechnology* 2009; 20:465305.

Xia Q, Murphy PF, Gao H, Chou SY. Ultrafast and selective reduction of sidewall roughness in silicon waveguides using self-perfection by liquefaction. *Nanotechnology* 2009; 20:345302.

Chang ASP, Morton KJ, Tan H, Murphy PF, Wu W, Chou SY. Tunable liquid crystal-resonant grating filter fabricated by nanoimprint lithography. *IEEE Photonics Technology Letters* 2007; 19:1457.

Murphy PF, Morton KJ, Fu Z, Chou SY. Nanoimprint mold fabrication and replication by room-temperature conformal chemical vapor deposition. *Applied Physics Letters* 2007; 90:203115.

Presentations

Wang C, Murphy PF, Yao N, McIlwrath K, Chou SY. Growth of straight crystal silicon nanowires on nanopatterned amorphous substrate with uniform diameter and length, preferred orientation, and predetermined location. 54th International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication (EIPBN), 2010.

Liang Y, Murphy PF, Chou SY. Controlled sub-20 nm nano-scale line fabrication using self-limited self-perfection by liquefaction. 53rd International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication (EIPBN), 2009.

Wang C, Murphy PF, Chou SY. Control of location, diameter, length, and orientation of Si nanowires grown on amorphous substrates using nanoimprint lithography and novel catalysts. 7th International Conference on Nanoimprint and Nanoprint Technology (NNT), 2008.

Murphy PF, Morton KJ, Chou SY. Nanoimprint mold fabrication and replication by RT-PECVD. 50th International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication (EIPBN), 2006.

Chang ASP, Morton KJ, Murphy PF, Tan H, Wu W, Chou SY. Tunable liquid crystal-resonant grating filters using superimposed grating structures fabricated by nanoimprint lithography. 17th Annual Meeting of the IEEE Lasers & Electro-Optics Society (LEOS), 2004.

Chang ASP, Morton KJ, Murphy PF, Chou SY. Superimposed grating structures fabricated using multi-level nanoimprint lithography for tunable resonant grating filters. 48th International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication (EIPBN), 2004.

Kalkhoran NM, Murphy PF. Camocell technology: a new surface texturing process for high efficiency color-matched silicon solar cells. 28th IEEE Photovoltaic Specialists Conference (PVSC), 2000.

Prior Experience

Research Assistant, Nanostructures Laboratory, Princeton University, 2003–2009
Research Assistant, Optical Characterization and Nanophotonics Laboratory, Boston University, 2001–2002
Research Assistant, Spire Corporation, 1999–2001

Peer Reviewer

- Applied Physics Letters
- Optics Express

Professional Affiliations

- Institute of Electronics and Electrical Engineers
- IEEE Photonics Society
- IEEE Power and Energy Society
- Optical Society of America
- National Association of Fire Investigators

Project Experience

Failure Analysis of Electronics and Consumer Products

Investigated the root cause of failures of a printed circuit board in a consumer medical device. Results used to make decision regarding product recall.

Contributed to a root-cause analysis to determine unexplained power outages at large, financial data centers.

Technical Analysis of Complex Electronic Systems and Networks

Analyzed the IPTV (internet protocol TV) telecommunications network for a major service provider, to assess the capacity of the network to accommodate live streaming video services.

Modeled interaction between radar facility and proposed large-scale solar energy installation to determine the potential for electromagnetic interference.

Contributed to a technical report on evolution and operating principles of flat-panel display technologies.

Quality Systems for High Tech Manufacturing

Developed an improved end-to-end quality management system for the manufacturer of highly engineered documents.

Intellectual Property

Developed a technical analysis and assessment program for determining product infringement related to fabrication methods, layout, and design of flash memory devices.

Developed a technical analysis and assessment program for determining intellectual property position related to architecture, protocols, and functionalities of financial service networks and terminals.

Fire and Accident Investigations

Conducted investigations to determine the cause and origin of fires related to heating elements, consumer products, and electrical components such as capacitors, as well as investigations related to the functioning of electronic systems in accidents and other incidents.

Exposure Assessments

Conducted exposure assessments per relevant standards for radio-frequency and utility-frequency electromagnetic field exposure limits.