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David Schoen, Ph.D., P.E.

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Professional Profile

Dr. Schoen holds academic degrees in Materials Science and Engineering and is a licensed Professional Engineer in Metallurgy.

In his 10 years at Exponent he has carried out hundreds of investigations and failure analyses related to the fabrication, processing, and characterization of electronic devices, components, photovoltaics, and optical thin films. He has experience with a variety of mechanical, chemical, optical, and electronic failure modes exhibited by electronic and optical materials, including fracture, corrosion, optical defects, and electronic failures. Of particular interest to Dr. Schoen are the material origins of optical and electronic behavior, and how certain damage events can leave material evidence behind.

Dr. Schoen's materials characterization experience extends to transmission and scanning electron microscopy (SEM, TEM, STEM), auger electron, energy dispersive, and electron spectroscopies (AES, EDS, EELS), diffraction, and other chemical analysis techniques such as time-of-flight secondary ion mass spectroscopy (ToF-SIMS) and ion chromatography (IC), with a focus on analysis and identification of composition, phase identification, and microstructure of materials.

Dr. Schoen completed his postdoctoral and graduate work at Stanford University in the research groups of Professors Yi Cui and Mark Brongersma. His work focused on the fabrication, phase behavior, and chemically and electrically-induced transformations in a variety of semiconductor devices, particularly for applications in nonvolatile memory and photovoltaics. During this time he developed several novel nanoscale devices, as well as an investigative strategy centered around the in-situ examination nanoscale devices during operation in the transmission electron microscope. Dr. Schoen's postdoctoral work focused on the application of nanoscale metal structures for optical applications.

Teaching has been another important component of Dr. Schoen's scientific experience. In addition to providing training and assistance for electron microscopy users to the larger Stanford Engineering community for 2 years during his Ph.D., he has served as a teaching assistant for Introduction to Solid State Chemistry during his bachelor's work at MIT, and more recently as a lecturer for Stanford's Thin Film and Interface Microanalysis course along with Professor Mark Brongersma. He is a member of the NCEES Exam Development Committee for the Metallurgical and Materials Professional Engineering exam.

Academic Credentials & Professional Honors

Ph.D., Materials Science and Engineering, Stanford University, 2010

M.S., Materials Science and Engineering, Stanford University, 2008

B.S., Materials Science and Engineering, Massachusetts Institute of Technology (MIT), 2005

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National Defense Science and Engineering Graduate Fellowship, 2005-2008

National Science Foundation Graduate Research Fellowship, 2009-2010 (awarded 2005)

Licenses and Certifications

Professional Engineer Metallurgical, California, #1983

Prior Experience

Post-Doctoral Researcher, Materials Science and Engineering Department, Stanford University, 2010-2013

Patents

Patent application– Water Sterilization Devices Including Nanostructures and Uses Thereof Inventors: Schoen DT, Schoen AP, Hu L, S.C. Heilshorn, Cui Y.

Publications

D. Schoen, M. Nevius, S. Chaudharay. “Semiconductor Characterization.” ASM Handbook, Volume 10: Materials Characterization. ASM International. 2019.

Multu M, Kang JH, Raza S, Schoen DT, Zheng X, Kik PG, Brongersma ML. Thermoplasmonic Ignition of Metal Nanoparticles. Nano Letters 2018. 18:1699-1706.

Schoen DT, Holsteen AL, Brongersma ML. Probing the electrical switching of a memristive optical antenna by STEM EELS. Nature Communications 2016. 7:12162.

Coenen T, Schoen DT, Mann SA, Roriguex SRK, Brenny BJM, Polman A, Brongersma ML. nanoscale spatial coherent control over the modal excitation of a coupled plasmonic resonator system. Nano Letters 2015; 15(11):7666-7670.

Lan S, Kan L, Schoen DT, Rodrigues SP, Cui Y, Brongersma ML, Cai W. Backward phase-matching for nonlinear optical generation in negative-index materials. Nature Materials 2015; 14: 807-811.

Schoen DT, Atre AC, García-Etxarri A, Dionne JA, Brongersma ML. Probing complex reflection coefficients in one-dimensional surface plasmon polariton waveguides and cavities using STEM-EELS. Nano Letters 2014; 15(1):120-126.

Park J, Kang J, Vasudev A, Schoen DT, Kim H, Hasman E, Brongersma ML. Omni-directional near-unity absorption in an ultrathin planar semiconductor layer on a metal substrate. ACS Photonics 2014; 1(9):812-821.

Chalabi H, Schoen DT, Brongersma ML. Hot-electron photodetection with a plasmonic nanostripe antenna. Nano Letters 2014; 14(3):1374-1380.

Schoen DT, Coenen T, De Abajo FJG, Brongersma ML, Polman A. The planar parabolic antenna. Nano Letters 2012; 13(1):188-193.

Schoen AP, Schoen DT, Huggins KN, Heilshorn S. Template engineering through epitope recognition. Journal of the American Chemical Society 2011; 133(45):18202-18207.

Schoen DT*, Schoen AP*, Hu L, Kim HS, Heilshorn S, Cui Y. High speed water sterilization using silver nanowires, carbon nanotubes, and cotton. Nano Letters 2010; 10:3628. *Equal contribution.

Schoen DT, Peng H, Cui Y. Anisotropy of chemical transformation from In2Se3 to CuInSe2 nanowires through solid state reaction. Journal of the American Chemical Society 2009; 131(23):7973.

Schoen DT, Meister S, Peng H, Chang C, Yuang Y, Cui Y. Phase transformations in one-dimensional materials: Applications in Electronics and Energy Sciences. Journal of Materials Chemistry 2009; 19(33):5879.

Meister S*, Schoen DT*, Topinka M, Minor A, Cui Y. Void formation induced electrical switching in phase-change nanowires. Nano Letters 2008; 8(12):4562-4567. *Equal Contribution.

Schoen DT, Xie C, Cui Y. Electrical switching and phase transformation in silver selenide nanowires. Journal of the American Chemical Society 2007; 129(14):4116-4117.

Lai KJ, Peng HL, Kundhikanjana W, Schoen DT, Xie C, Meister S, Cui Y, Kelley MA, Shen ZX. Nanoscale electronic inhomogeneity in In2Se3 nanoribbons revealed by microwave impedance microscopy. Nano Letters 2009; 9(3):1265.

Peng HL, Xie C, Schoen DT, Cui Y. Large anisotropy of electrical properties in layer-structured In2Se3 nanowires. Nano Letters 2008; 8(5):1511-1516.

Peng HL, Xie C, Schoen DT, McIlwrath K, Zhang XF, Cui Y. Ordered vacancy compound and nanotube formation in CuInSe(2)-CdS core-shell nanowires. Nano Letters 2007; 7(12):3734-3738.

Peng HL, Schoen DT, Meister S, Cui Y. Synthesis and phase transformation of In2Se3 and CuInSe2 nanowires. Journal of the American Chemical Society 2007; 129(1):34-35.

Schuh CA, Schoen DT, Lund AC. Strength variations during mechanical alloying through the nanostructural range. MRS Proceedings 2003; 791. Q11.3.1.

Selected Talks and Posters

Schoen DT, Brongersma ML. Mapping plasmonic modes of crossed Ag nanowire waveguides by EELs. Invited Talk, Stanford Photonics Research Conference, Fall 2012.

Schoen DT, Coenen T, De Abajo FJG, Polman A, Brongersma ML. The planar parabolic antenna. Gordon Research Conference: Plasmonics, Spring 2012.

Schoen DT, Brongersma ML. High resolution structural and optical characterization of top-down and bottom-up engineered plasmonic nanostructures. Oral presentation, SPIE Optics+Photonics, Summer 2012.

Schoen DT, Schoen AP, Hu L, Heilshorn S, Cui Y. Inorganic nanowires for improved water filtration. Oral presentation, MRS Boston, Fall 2009.

Schoen DT, Peng H, Cui Y. Single nanowire CIS solar cells. Poster, MRS Boston, Fall 2009.

Schoen DT, Cui Y. Complex branched and heterostructured nanowires by nanoepitaxy. Invited Oral Presentation, SPIE Optics + Photonics, Summer 2009.

Presentations

Bennett-Kennett R, Semenikhin N, Brooke P, Schoen D, Guyer E. Corrosion mitigation in actuator design. AMPP 2026, Houston, TX, 2026.