

Armin Darvish

Senior Scientist

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SF Bay Area, CA

Effective, focused, goal-driven R&D scientist with a broad background in multidisciplinary science and technology and years of experience in single-molecule biosensing platforms. Extensive knowledge as well as hands-on experience in materials science, process engineering, micro/nanofabrication, signal and image processing, multiphysics modeling, experimental design and statistical data analysis as well as molecular biochemistry. Enjoy working within multidisciplinary teams and find fast-paced and high-risk, high-reward situations very inspiring.

PROFESSIONAL EXPERIENCE

Robert Bosch LLC, Sunnyvale, CA

Senior Scientist

Research Scientist

Jan 21 to Present

Oct 19 to Jan 21

At Bosch, I am a scientist in the "Bioelectronics" team within the corporate research organization. We design novel biosensors and take them from early stage proof-of-concept to the productization phase before handing them off to other business units within Bosch. My focus has been platform development and integration based on novel electrical nanobiosensors for single-molecule applications. I perform a wide range of tasks from making devices in the clean room to characterizing them using analytical techniques to designing and conducting single-molecule experiments as well as signal processing and data analysis.

Examples include:

- Nanosensor chip design and fabrication (e.g. low current nanoelectronic sensors for single molecule applications)
- Device characterization (From electron microscopy to electro-optical measurements, etc.)
- Design and prototyping fluidic interfaces for connecting nanosensor chips to measurement setup (electrical or optical)
- Single-molecule assays (from assay design to doing experiments) including electrochemical measurements as well as fluorescent microscopy to understand single molecule biophysics and troubleshoot/optimize our platform capabilities
- Signal or image processing (using python to read measurement data and extract single-molecule events, etc.)
- Training interns on various research activities (nanofabrication, bioassays, etc.)
- Scouting new technologies and proposing new research ideas within the strategic portfolios at Bosch
- Write patents and papers publication on previous activities that can be shared with the public
- Scouting for new partners (industry/academic collaborators) and propose collaboration efforts

Quantapore Inc., Menlo Park, CA

Senior Scientist and Nanofabrication Lead

Jul 18 to Oct 19

I had a broad range of responsibilities covering development and optimization of Quantapore's nanopore-based sequencing technology. This involved process development and integration for chip design and manufacturing, as well as running sequencing experiments to optimize the overall platform. My key responsibilities were:

- Performance optimization and platform integration of Quantapore's sequencing system by improving chip and system architecture or experimental setups and conditions (improving signal-to-noise, increasing throughput, accuracy, run time, etc.). This included troubleshooting chip design and fabrication, as well as performing single-molecule optical measurements on Quantapore's proprietary system.
- Designing experiments and doing data analysis on single-molecule nanopore sequencing platform
- Hiring and training engineers as well as other administrative duties for managing nanofabrication department
- Leading the design and development of the next generation of Quantapore's solid-state nanopore sensor.
- Leading negotiations with manufacturing partners for solid-state nanopore chips.

Two Pore Guys Inc. (Later Operating as Ontera Inc.), Santa Cruz, CA

Nanopore Device Physics Engineer

Jul 16 to Jul 18

Worked within a team of scientists and engineers with a broad range of responsibilities falling under system design. I was the project lead for transferring Ontera's biosensor from lab-scale proof-of-concept to mass-scale production, as well as implementing quality control and testing. This included interfacing with production partners for process transfer. I was a key player in enabling series A funding at Two Pore Guys. Key achievements can be summarized as:

- Developed new process flow for mass-scale nanopore production increasing throughput to several 1000s of sensors/week and managed the production line of nanopore sensors including managing lot history record, inventory, and performance record database, then led the technical negotiations with manufacturing partners for process transfer.
- Started the system integration team to implement system-level change control for product release as well as ensuring quality control and performing failure analysis at system level
- Designed and implemented statistical process control (SPC) to increase production yield to >80%. This included writing a python script to make wafer maps, correlation plots, and Pareto charts for yield improvement studies and presenting the data to other groups (R&D, Engineering, Biochemistry, Operations, etc.)
- Developed standard operating procedures (SOP) for in-situ nanopore conditioning and ion current measurements as well as signal processing for nanopore characterization

TECHNICAL SKILLS

Micro/Nanofabrication and Materials Science:

- photolithography and e-beam lithography (>500 wafers for PL and >50 wafers of EBL)
- thin film deposition (LPCVD, and PECVD), plasma etching, wet etching, etc. (> 500 wafers)
- focused ion beam (>600 hours hands-on experience with FEI Strata DB235 and Helios 600i)
- scanning electron microscopy (>200 hours hands-on experience with Zeiss Supra 50VP and FEI Magellan 400 XHR)
- transmission electron microscopy and EELS (>400 hours hands-on experience with JEOL JEM210, FEI Tecnai and Titan)
- bottom-up synthesis of nanoparticles (quantum dots, gold nanodots, layered nanohydroxides, etc.)
- surface functionalization techniques (self-assembled monolayers, protein immobilization, etc.)
- dynamic light scattering (>50 hours experience with Malvern Zetasizer and Delsa Nano Submicron),
- plate-reader (>50 hours experience with Tecan Infinite M200 and others)
- fluorescence and UV/vis spectroscopy (>50 hours experience with Perkin Elmer instruments)
- raman spectroscopy (>30 hours experience with Renishaw-Leica Confocal Raman Microscope)
- atomic absorption spectroscopy (>30 hours experience with Varian AA240FS flame AAS)

Computation/Programming:

- Python: Signal Processing, Data Processing, Image Processing, Statistical Analysis and GUI with PyQT
- MATLAB: signal processing, image processing, GUI
- COMSOL: modeling device physics (nanofluidics, electrochemistry and heat/mass transfer)
- Layout Editor and L-Edit: layout design for lithography
- R programming, SPSS and Origin: statistical analysis and plotting
- Imagej: particle size analysis, gel analysis, etc.
- HTML and CSS

Cellular and Molecular Biochemistry:

- molecular assays (ELISA, Western Blot, Biacore SPR)
- bioconjugation chemistries
- dialysis and gel filtration
- gel-electrophoresis
- lyophilization and ultracentrifugation
- polymerase chain reaction (PCR)
- cell culture and cell toxicity assays
- aseptic and sterile technique
- virus production, purification, and infectivity assays

EDUCATION

Drexel University, Philadelphia, PA

PhD in Biomedical Engineering, 2016

Research: Electrodeformation in solid-state nanopores for characterization of nanoscale vesicles and viruses

Made solid-state nanopores for single molecule detection (DNA and proteins) as well as single particle detection (liposomes, exosomes, viruses and nanoparticles). Developed a novel method for morphological analysis of soft particles (virus/vesicle)

My main achievements were:

- Modeled biophysics of particle translocation through nanopores in COMSOL, particularly to correlate particle shape and resistive pulse signal
- Fabricated solid-state nanopore devices for detecting single molecules and particles
- Wrote of GUI-enabled software in MATLAB for automated batch-processing of nanopore resistive pulse signals
- Wrote an image-processing software in MATLAB to analyze kinetics of nanopore shrinking by electron microscopy
- Oversaw general upkeep of the lab, generated and documented standard operating protocols, and implemented laboratory policies and safety regulations.
- Trained undergraduate students on micro/nanofabrication, photolithography, focused ion beam, and electron microscopy

Drexel University, Philadelphia, PA

M.Sc. in Biomedical Engineering, 2012

Research: Synthesis and Functionalization of Gold Nanoclusters with HIV attachment inhibitors. I made quantum dots labeled with anti-HIV peptides for analysis of drug-antigen interactions. Main activities included:

- Synthesized novel water-soluble biocompatible quantum dots (gold and CdSe dots),
- Functionalization quantum dots with peptides, proteins, and DNA using various bioconjugation chemistries
- Performed biochemical assays such as enzyme linked immunosorbent assay (ELISA), western blot, etc. to study toxicity and binding of quantum dots to small molecules, cells, and viruses
- Performed microscopy (fluorescence, confocal, etc.) to analyze binding of quantum dots to antigens on cells

Amirkabir University of Technology, Tehran, Iran

Bachelor of Science in Biomedical Engineering, 2010

Research: Synthesis and Characterization Gd-containing Layered Nanohydroxide Particles MRI Contrast Agents

Developed a new synthesis method to incorporate magnetic contrast agents (Gd-containing compounds) for a class of nanoparticles that were used in drug delivery applications and characterized them with XRD, SEM, TEM, and etc.

SELECTED PATENTS AND PUBLICATION

- Y. S. Shin, N. Fomina, C. Johnson, **A. Darvish**, and C. Lang. "Measuring ion strength using closed-loop electrochemical ph modulation." U.S. Patent Application 17/184,274, filed August 25, 2022.
- Y. S. Shin, N. Fomina, C. Johnson, **A. Darvish**, E. Papageorgiou, and C. Lang. "Closed-loop ph control with differential sensor." U.S. Patent Application 16/931,727, filed January 20, 2022.
- C. Johnson, S. Kavusi, N. Fomina, H. Ahmad, A. Maruniak, C. Lang, A. Raghunathan, Y. S. Shin, **A. Darvish**, and E. Papageorgiou. "Electronic control of the ph of a solution close to an electrode surface." U.S. Patent Application 16/932,096, filed November 19, 2020.
- J. S. Lee, S. Jugal, Y. N. D. Bandara, B. I. Karawdeniya, G. Goyal, **A. Darvish**, ... , and M. J. Kim, "Stiffness measurement of nanosized liposomes using solid-state nanopore sensor with automated recapturing platform." Electrophoresis 40(2019): 1337-1344.
- **A. Darvish**, J. S. Lee, B. Peng, ... & M. J. Kim, "Mechanical characterization of HIV-1 with a solid-state nanopore sensor," Electrophoresis. Aug 27, 2018.
- **A. Darvish**, G. Goyal, R. Aneja, R. V. Sundaram, K. Lee, C. W. Ahn & M. J. Kim, "Nanoparticle mechanics: deformation detection via nanopore resistive pulse sensing," Nanoscale, 8(30), 14420-14431, 2016.
- G. Goyal, Y. B. Lee, **A. Darvish**, C. W. Ahn, & M. J. Kim, "Hydrophilic and size-controlled graphene nanopores for protein detection," Nanotechnology, 27(49), 495301, 2016.
- G. Goyal, **A. Darvish**, and M. J. Kim, "Use of solid-state nanopores for sensing co-translocational deformation of nano-liposomes," Analyst 140.14 (2015): 4865-4873.
- G. Goyal, R. Mulero, J. Ali, **A. Darvish**, Min Jun Kim, "Low aspect ratio micropores for single-particle and single-cell analysis," Electrophoresis, 36(9-10), 1164-1171, 2015.
- M. S. Azimi, Z. T. Birgani, **A. Darvish**, S. S. Shafiei, M. Solati-Hashjin, "Ca/Al Layered Double Hydroxides: An Advanced Nanoceramic for Biomaterials Applications ", European Cells and Materials Vol. 19. Suppl. 1, pp. 19, 2010.