

# Abdullah Saud Abbas

## Materials Engineer



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## WORK EXPERIENCE

**University of California, Berkeley, PhD Candidate** / January 2019 – December 2023 (expected)

Synthesis of Highly Luminescent and Monodispersed Nanocrystals

- Synthesized Perovskite, Cadmium Chalcogenide and Lead Chalcogenide Nanocrystals
- Solid-State laser cooling investigation through rigorous structural and optical optimizations

**Quantum Solutions Inc, VP of Product** / May 2018 – July 2018

Product Management

- Created product inventory and ensured products were stocked up for potential orders
- Managed orders from manufacturing, packaging to shipping to the customers

**Quantum Solutions Inc, Product Developer** / December 2017 – May 2018

Large Scale Production of PbS Quantum Dots Using Microfluidic Flow-based Reactor

- Synthesizing high quality PbS quantum dots with various sizes based on customers needs
- Building devices such as solar cells and photodetectors for demonstration purposes
- Helping our customers to properly use and handle the materials for their applications

Perovskite Quantum Dots For LCDs and UV Detector Applications

- Synthesizing highly luminescent perovskite quantum dots with very narrow emission.
- Preparing quantum dots/polymer films for backlighting layer for LCDs application
- Preparing quantum dots ink for colour filters for LCDs application

### Pitch Competitions:

2018 Pitched in **MIT Enterprise Forum** and won first place with an award of 100k SAR (\$26k)

**DropLab (Capstone Project), Co-Founder** / September 2016 – July 2017

Worked on a device for digitally manipulating the motion of fluid drops. The device required an adjustable AC Signal Amplifier operating at very high voltages. The various circuit designs were evaluated using simulation tools, and machined using an in-house CNC. This project also involved material science principles in order to create hydrophobic and dielectric coatings whose wetting characteristics were a function of the applied voltage.

**Awards & Grants:** Our initial promising work won us:

- 2017 Award (\$10,000) by The Norman Esch Entrepreneurial Challenge
- 2017 Award (\$5000) by Autodesk for Capstone Design
- 2017 Award (\$2500) by Engineering of the Future
- 2016 Award (\$5,000) by Baylis Medical
- 2016 Award (\$4,000) by Engineering of the Future
- 2016 Award (\$1,400) by the Department of Nanotechnology Engineering

**University of California, Berkeley** / January – August 2016

**Undergraduate Research Assistant, P. Alivisatos Research Group**

Energy Transfer Dynamics in Quantum Dot Binary Nanocrystal Superlattices

- Synthesized CdSe-CdS Core-Shell quantum dot with various sizes
- Prepared Self-Assembled Binary Nanocrystal Superlattices
- Achieved different crystal structures, such as  $MgZn_2$ ,  $CaCu_5$ ,  $AB_2$ , and  $AB_{13}$

CdTe Thin Film Solar Cells

- Helped setting up device fabrication and testing
- Synthesized CdTe tetrapods and prepared ink for solar cells
- Improved solar cell efficiency from %3 to %7, highest efficiency achieved at Alivisatos lab.

**Undergraduate Research Assistant, Sargent Research Group**

Quantum Dots Solar Cells (pioneered certifying 9.9%, a previous world record)

- Synthesized ZnO nanoparticles and prepared PbS quantum dot solutions
- Prepared solar cells through solution-processed techniques
- Used Thermal Evaporation/Sputtering for device's Electrode
- Characterized devices by SEM, Profilometer, & photo physics techniques

**King Abdullah University of Science and Technology (KAUST) / January – April 2014**

**Undergraduate Research Assistant, O. Mohammad Research Group**

Ultrafast reaction dynamics of organic molecules

- Photophysics dynamics of Donor-Acceptor materials

Semi-conductor thin films for high-speed electronics

- Multilayer thin film deposition of different oxides

**University of Waterloo / April – December 2013**

**Undergraduate Research Assistant, V. Maheshwari Research Group**

Single Electron Transistor using Au nanoparticles and ZnO Nanowires

ZnO/ Cu<sub>2</sub>O pn-junction Solar Cells



## EDUCATION

**Visiting PhD Student:** Chemistry,

University of Chicago, Supervisor: Paul Alivisatos / July 2022 – December 2023 (expected)

**Doctor of Philosophy (PhD):** Materials Science and Engineering,

University of California, Berkeley, Supervisor: Paul Alivisatos / January 2019 – December 2023 (expected)

**Master of Science in Engineering:** Materials Science and Engineering,

University of California, Berkeley, Supervisor: Paul Alivisatos / January 2019 – May 2021

- Earned with a GPA of 3.568/4

**Bachelor of Applied Science:** Honours Nanotechnology Engineering,

Co-operative Program University of Waterloo / September 2012 – April 2017

- Graduated with distinction with a GPA of 3.7/4

**Relevant courses:** Organic Electronics NE 479, Photonics Materials and Devices NE 445, Nanoelectronics NE 471, Nanoprobng and Lithography NE 353, Microfabrication and Thin Film Technology NE 343, Electronic Circuit NE 344, Electronic Devices NE 242



## TECHNICAL SKILLS

**Simulation and Scripting Languages**

Quantum Espresso (DFT engine), Vesta, Scaps (solar simulator tool), ImageJ (for SEM analysis), KiCad & EagleCad (for Circuit Design), PSpice and OrCAD Capture (for circuit simulation), CNC (for rapid circuit prototyping), Fusion360 (for 3D printing), Arduino, Python, MATLAB (including Numerical Methods), COMSOL Multiphysics

**Fabrication and growth**

Airless Quantum Dots Synthesis, Oxide Nanoparticle Synthesis, PVD (Sputtering), Thermal Evaporation, Electrodeposition, Photo-Lithography.

**Characterization**

Scanning Electron Microscope (SEM), Energy-dispersive X-ray Spectroscopy (EDX), Transmission Electron Microscope (TEM), Atomic Force Microscopy (AFM), X-Rays Diffraction (XRD), Selected-Area Electron Diffraction (SAED), FTIR Spectrometer, Raman Spectrometer, Ellipsometry, Profilometer (Dektak), Spectrophotometer, Spectrofluorometer, Mechanical probe station, Oscilloscope, Optical Microscope.



- [1] **Abdullah S. Abbas**, Emma Vargo, Vida Jamali, Peter Ercius, Priscilla F. Pieters, Rafaela M. Brinn, Assaf Ben-Moshe, Min Gee Cho, Ting Xu, and A. Paul Alivisatos. Observation of an Orientational Glass in a Superlattice of Elliptically-Faceted CdSe Nanocrystals. *ACS Nano* **2022**, 16 (6), 9339–9347.
- [2] Steven A. Hawks, **Abdullah S. Abbas**, and A. Paul Alivisatos. Aspects of Sintering CdTe Nanoparticles into Functional Bulk Absorber Layers. *IEEE 43rd Photovoltaic Specialists Conference, Portland, June 2016*.
- [3] Mengxia Liu, F. Pelayo García de Arquer, Yiyang Li, Xinzheng Lan, Gi-Hwan Kim, Oleksandr Voznyy, Lethy Krishnan Jagadamma, **Abdullah Saud Abbas**, Zhenghong Lu, Aram Amassian, Sjoerd Hoogland, and Edward H. Sargent. Double-Sided Junctions Enable High-Performance Colloidal Quantum Dot Photovoltaics. *Adv. Mater.* **2016**, 28 (21), 4142-4148.
- [4] Xinzheng Lan, Oleksandr Voznyy, Amirreza Kiani, F. Pelayo García de Arquer, **Abdullah Saud Abbas**, Gi-Hwan Kim, Mengxia Liu, Zhenyu Yang, Grant Walters, Jixian Xu, Mingjian Yuan, Zhijun Ning, Fengjia Fan, Pongsakorn Kanjanaboos, Illan Kramer, David Zhitomirsky, Philip Lee, Alexander Perelgut, Sjoerd Hoogland, and Edward H. Sargent. Passivation using molecular halides increases quantum dot solar cell performance. *Adv. Mater.* **2016**, 28 (2), 299-304.
- [5] Gi-Hwan Kim, F. Pelayo García de Arquer, Yung Jin Yoon, Xinzheng Lan, Mengxia Liu, Oleksandr Voznyy, Lethy Krishnan Jagadamma, **Abdullah Saud Abbas**, Zhenyu Yang, Fengjia Fan, Alexander H. Ip, Pongsakorn Kanjanaboos, Sjoerd Hoogland, Aram Amassian, Jin Young Kim, Edward H. Sargent. High Efficiency Colloidal Quantum Dot Photovoltaics via Robust Self-Assembled Monolayers. *Nano Lett.* **2015**, 16 (1), 822.
- [6] J. I. Khan, **A. S. Abbas**, M. S. Aly, A. Usman, V. Melnikov, E. Alarousu, O. F. Mohammed. Photoinduced Energy and Electron Transfer in Rubrene-Porphyrin and Rubrene-Benzoquinone Molecular Associations. *Chem. Phys. Lett.* **2014**, 616–617, 237-242.
- [7] L. Pu, **A. S. Abbas**, V. Maheshwari. Electrochemical Synthesis on Nanoparticle Chains to Couple Semiconducting Rods: Coulomb Blockade Modulation Using Photoexcitation. *Adv. Mater.* **2014**, 26 (37), 6491-6496.
- [8] Arwa Saud Abbas, Sondos Alqarni, Babak B. Shokouhi, **Abdullah Saud Abbas**, Mustafa Yavuz, and Bo Cui. Metal and organic nanostructure fabrication by electron beam lithography and dry liftoff. *14th IEEE International Conference on Nanotechnology, Toronto, August 2014*.



## **CONFERENCE POSTERS**

- [1] Lutfan Sinatra, Marat Lutfullin, **Abdullah Saud Abbas**, Jun Pan, Osman M Bakr. “P-203: Late-News Poster: Novel Techniques for Highly Stable Luminescent Perovskite Halide Quantum Dots”, SID, Los Angeles, CA, USA May, 2018
- [2] Steven A. Hawks, **Abdullah S. Abbas**, A. Paul Alivisatos, “Sintered CdTe Nanocrystals for Solar Cell Absorber Layers”, Bay Area Photovoltaic Consortium, Palo Alto (Stanford University), United State, May 2016.
- [3] Xinzheng Lan, Oleksandr Voznyy, Amirreza Kiani, F. Pelayo García de Arquer, **Abdullah Saud Abbas**, Gi-Hwan Kim, Mengxia Liu, Zhenyu Yang, Grant Walters, Jixian Xu, Mingjian Yuan, Zhijun Ning, Fengjia Fan, Pongsakorn Kanjanaboos, Illan Kramer, David Zhitomirsky, Philip Lee, Alexander Perelgut, Sjoerd Hoogland, and Edward H. Sargent, “Passivation Using Molecular Halides Increases Quantum Dot Solar Cell Performance”, Waterloo Undergraduate Nanotechnology Conference, Waterloo, Ontario, Canada, November 2015.
- [4] **Abdullah S. Abbas**, et al, Edward H. Sargent, “Scale-up of Colloidal Quantum Dot Solar Cells: Spray-Coating”, IC-IMPACTS Annual General Meeting and Research Conference, Vancouver, British Columbia, Canada, March 2015.
- [5] L. Pu, **A. S. Abbas**, V. Maheshwari, “Electrochemical Synthesis on Nanoparticle Chains to Couple Semiconducting Rods: Coulomb Blockade Modulation Using Photoexcitation”, KAUST Undergraduate Research Competition, Thuwal, Jeddah, Saudi Arabia, January 2015.