

Yasser Khan

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Summary

I am an engineer/maker/scientist working on multi-disciplinary projects at the intersection of engineering, materials science, biology, and artificial intelligence. My research focuses on additive manufacturing and hardware AI to produce skin-like wearables, implantables, and ingestibles. These medical devices are being used for precision health and psychiatry.

Research Interests

Materials and Devices: wearable/implantable/ingestible electronics, sensors, medical devices, bioelectronics, biophotonics.

Manufacturing and Systems: flexible/stretchable/printed/hybrid electronics, additive manufacturing, in-sensor processing, machine learning on edge systems.

Application: health/mental health monitoring, precision health/psychiatry.

Education

Ph.D. in Electrical Engineering and Computer Sciences

GPA 3.95/4.00, Concentration: *Physical Electronics*.

University of California, Berkeley, CA, USA

Dec '18



Dissertation: Wearable medical sensors enabled by printed bioelectronics and biophotonics.

Advisor: [Professor Ana Claudia Arias](#).

M.S. in Electrical Engineering

GPA 3.92/4.00, Concentration: *Optoelectronics and Photonics*.

KAUST, KSA

Dec '12



Thesis: Light management in optoelectronic devices with disordered and chaotic structures.

Advisor: [Professor Boon Ooi](#); Co-Advisor: [Professor Andrea Fratalocchi](#).

B.S. in Electrical Engineering

GPA 3.98/4.00, *Summa Cum Laude*, Concentration: *Electronics*.

University of Texas at Dallas, TX, USA

May '10



Senior Design Project: Wireless embedded control system for atomically precise manufacturing.

Faculty Advisor: [Professor Murat Torlak](#); Industry Advisor: [John Randall, PhD](#).

Experience

Assistant Professor of Electrical and Computer Engineering

University of Southern California, CA, USA

Jan '22–Present



Stanford University, CA, USA

Jan '19–Dec '21

Stanford

Postdoctoral Scholar in Chemical Engineering

- **Wearable sensor system for biochemical analysis of bodily fluids**

Designed and implemented a wearable sensor system that collects and processes data from a variety of sensors for real-time analysis of bodily fluids.

- **Wearable mental health monitoring platform**

Developed a skin-like sensor platform that utilizes physiological and chemical sensors to monitor mental health biotypes.

- **Non-invasive ventilator for COVID-19**

Designed a non-invasive ventilator with a helmet interface that is safe, low-cost, portable, and can provide relief to early-stage COVID-19 patients.

Advisor: [Professor Zhenan Bao](#); Co-Advisor: [Professor Boris Murmann](#).

University of California, Berkeley, CA, USA

Jul '13–Dec '18

Berkeley
UNIVERSITY OF CALIFORNIA

Ph.D. Student

- **Printed biophotonic sensors for blood and tissue oximetry**

Demonstrated a flexible organic reflectance oximeter array capable of 2D oxygenation mapping of blood and tissue [1]. Developed the first printed organic optoelectronic sensor for transmission-mode pulse oximetry [3]. Additionally, reported a reflection-mode organic oximeter probe for pulse oximetry on the wrist [10].

- **Printed bioelectronic sensors for electrocardiography (ECG), electromyography (EMG), and bioimpedance spectroscopy**

Developed a fabrication process for producing thin, printed, and flexible electrode arrays that non-invasively map pressure-induced tissue damage via bioimpedance spectroscopy, even when such damage cannot be visually observed [4, 5]. Also, demonstrated printed electrode arrays for wearable ECG and EMG [?].

- **Integration of printed sensors to flexible hybrid electronics for wearable health monitoring**

Developed a wearable sensor patch composed of inkjet-printed gold ECG electrodes and a stencil-printed nickel oxide thermistor to record ECG and human body temperature [2].

- **Other Responsibilities:** Designing and maintaining the group website: arias.berkeley.edu.

Advisor: [Professor Ana Claudia Arias](#).

University of California, Berkeley, CA, USA

Oct '12–Jun '13

Berkeley
UNIVERSITY OF CALIFORNIA

Research Intern

- **Printed optoelectronic probe for pulse oximetry**

Developed hardware and software for interfacing conventional electronics with organic light-emitting diodes (OLEDs) and organic photodiodes (OPDs) for measuring blood oxygen saturation [3].

Advisor: [Professor Ana Claudia Arias](#).

Oxford University, OX, UK

Jul '11–Aug '11

 UNIVERSITY OF
OXFORD

Research Intern

- **Enhancing light scattering and absorption in dye-sensitized solar cells (DSSCs) with air voids in TiO_2 nano-spheres**

With Mie theory and T-matrix formulation calculated scattering properties of air voids in TiO_2 nano-spheres. Optimized air void sizes and concentrations for greater efficiencies in DSSCs.

Math Advisor: [James Kirkpatrick, PhD](#); Physics Advisor: [Professor Henry Snaith](#).

Graduate Student Researcher

KAUST, KSA
Sep '10–Jul '12



- **Energy harvesting in complex systems**
Experimentally investigated light trapping capabilities of deformed microstructures for energy harvesting [20].
 - **Zinc oxide (ZnO) nanorods for simultaneous light trapping and transparent electrode applications in solar cells**
Studied light concentrating properties of ZnO nanorods, and at the same time evaluated those for using as transparent electrodes [?].
 - **Electrochemical etching of tungsten tips for scanning tunneling microscopy (STM) and atomic force microscopy (AFM)**
Etched ultra-sharp metallic tips for scanning probe microscopy. [19].
 - **Other Responsibilities:** Designing and maintaining the group website: photonics.kaust.edu.sa.
- Advisor: **Professor Boon Ooi**; Co-Advisor: **Professor Andrea Fratalocchi**.

Research Intern

Stanford University, CA, USA
Jul '10–Aug '10
Stanford

- **Silver nanowire transparent electrodes for replacing existing Indium Tin Oxide (ITO) transparent electrodes in organic solar cells**
Worked on solution synthesis to produce 10 μ m length silver nanowires. Developed a Matlab tool to analyze the electrical response of silver nanowires, and wrote an image processing program for processing SEM images of nanowires.
- MSE Advisor: **Professor Yi Cui**; EE Advisor: **Professor Peter Peumans**.

Hardware Design Intern

Zyvex Labs, TX, USA
Jan '10–Jun '10
zyvex
LABS

- **Computer controlled electrochemical etcher to produce extremely sharp tips for use in STM**
Developed hardware and software for an automated electrochemical tip etcher. Zyvex Labs commercialized the etcher as Zetcher.
- Advisor: **Joshua Ballard, PhD**.

Publications

Please check [Google Scholar](#) and [Publons](#) for the up-to-date publications list.

Journal Articles

- [1] **Yasser Khan**, Donggeon Han, Adrien Pierre, Jonathan Ting, Xingchun Wang, Claire M Lochner, Gianluca Bovo, Nir Yaacobi-Gross, Chris Newsome, Richard Wilson, and Ana C Arias. A flexible organic reflectance oximeter array. **Proceedings of the National Academy of Sciences**, 115(47):E11015–E11024, 2018. doi: 10.1073/pnas.1813053115. URL <http://dx.doi.org/10.1073/pnas.1813053115>. **Media coverage:** [Physics World](#), [UC Berkeley News Center](#), [KCBS Radio](#), [Innovators Magazine](#), [The Engineer \(UK\)](#), [Medgadget](#), [ScienceDaily](#), and many more.
- [2] **Yasser Khan**, Mohit Garg, Qiong Gui, Mark Schadt, Abhinav Gaikwad, Donggeon Han, Natasha AD Yamamoto, Paul Hart, Robert Welte, William Wilson, Steve Czarnecki, Mark Poliks, Zhanpeng Jin, Kanad Ghose, Frank Egitto, James Turner, and Ana C Arias. Flexible hybrid electronics: Direct interfacing of soft and hard electronics for wearable health monitoring. **Advanced Functional Materials**, 26(47):8764–8775, 2016. doi:

10.1002/adfm.201603763. URL <http://dx.doi.org/10.1002/adfm.201603763>.

- [3] Claire M Lochner*, Yasser Khan*, Adrien Pierre*, and Ana C Arias. All-organic optoelectronic sensor for pulse oximetry. *Nature communications*, 5:5745, 2014. doi: [10.1038/ncomms6745](https://doi.org/10.1038/ncomms6745). URL <http://dx.doi.org/10.1038/ncomms6745>. *Equal contribution. Media coverage: [UC Berkeley Grad News](#), [NSF Science 360 News](#), [UC Berkeley News Center](#), [Phys.Org](#), [ScienceDaily](#), [MSN News](#), [Yahoo News](#), and many more.
- [4] Yasser Khan*, Felipe J Pavinatto*, Monica C Lin, Amy Liao, Sarah L Swisher, Kaylee Mann, Vivek Subramanian, Michel M Maharbiz, and Ana C Arias. Inkjet-printed flexible gold electrode arrays for bioelectronic interfaces. *Advanced Functional Materials*, 26(7):1004–1013, 2016. doi: [10.1002/adfm.201503316](https://doi.org/10.1002/adfm.201503316). URL <http://dx.doi.org/10.1002/adfm.201503316>. Cover article.
- [5] Sarah L Swisher, Monica C Lin, Amy Liao, Elisabeth J Leeflang, Yasser Khan, Felipe J Pavinatto, Kaylee Mann, Agne Naujokas, David Young, Shuvo Roy, Michael R Harrison, Ana C Arias, Vivek Subramanian, and Michel M Maharbiz. Impedance sensing device enables early detection of pressure ulcers in vivo. *Nature communications*, 6:6575, 2015. doi: [10.1038/ncomms7575](https://doi.org/10.1038/ncomms7575). URL <http://dx.doi.org/10.1038/ncomms7575>. Media coverage: [BBC News](#), [UC Berkeley News Center](#), [Futurity](#), [NSF News](#), [ACM Communications](#), and many more.
- [6] Yasser Khan, Aminy E Ostfeld, Claire M Lochner, Adrien Pierre, and Ana C Arias. Monitoring of vital signs with flexible and wearable medical devices. *Advanced Materials*, 28(22):4373–4395, 2016. doi: [10.1002/adma.201504366](https://doi.org/10.1002/adma.201504366). URL <http://dx.doi.org/10.1002/adma.201504366>.
- [7] Yasser Khan, Arno Thielens, Sifat Muin, Jonathan Ting, Carol Baumbauer, and Ana C. Arias. A new frontier of printed electronics: Flexible hybrid electronics. *Advanced Materials*, n/a(n/a):1905279, 2019. doi: [10.1002/adma.201905279](https://doi.org/10.1002/adma.201905279). URL <http://dx.doi.org/10.1002/adma.201905279>.
- [8] Yasser Khan, Hossain Mohammad Fahad, Sifat Muin, Hongquan Li, Ray Chang, Karthik Gopalan, Syed Tariq Reza, and Manu Prakash. A low-cost, helmet-based, non-invasive ventilator for covid-19. 2020. URL <https://arxiv.org/abs/2005.11008>.
- [9] Yasser Khan, Donggeon Han, Jonathan Ting, Maruf Ahmed, Ramune Nagisetty, and Ana C. Arias. Organic multi-channel optoelectronic sensors for wearable health monitoring. *IEEE Access*, 2019. doi: [10.1109/ACCESS.2019.2939798](https://doi.org/10.1109/ACCESS.2019.2939798). URL <http://dx.doi.org/10.1109/ACCESS.2019.2939798>.
- [10] Donggeon Han, Yasser Khan, Jonathan Ting, Simon M King, Nir Yaacobi-Gross, Martin J Humphries, Christopher J Newsome, and Ana C Arias. Flexible blade-coated multicolor polymer light-emitting diodes for optoelectronic sensors. *Advanced Materials*, 29(22):1606206, 2017. doi: [10.1002/adma.201606206](https://doi.org/10.1002/adma.201606206). URL <http://dx.doi.org/10.1002/adma.201606206>.
- [11] Xiaodong Wu, Yasser Khan, Jonathan Ting, Juan Zhu, Seiya Ono, Xinxing Zhang, Shixuan Du, James W. Evans, Canhui Lu, and Ana C. Arias. Large-area fabrication of high-performance flexible and wearable pressure sensors. *Advanced Electronic Materials*, n/a(n/a):1901310, 2020. doi: [10.1002/aelm.201901310](https://doi.org/10.1002/aelm.201901310). URL <http://dx.doi.org/10.1002/aelm.201901310>.
- [12] Xiaodong Wu, Maruf Ahmed, Yasser Khan, Margaret E. Payne, Juan Zhu, Canhui Lu, James W. Evans, and Ana C. Arias. A potentiometric mechanotransduction mechanism for novel electronic skins. *Science Advances*, 6(30), 2020. doi: [10.1126/sciadv.aba1062](https://doi.org/10.1126/sciadv.aba1062). URL <http://dx.doi.org/10.1126/sciadv.aba1062>.
- [13] Donggeon Han, Yasser Khan, Jonathan Ting, Juan Zhu, Craig Combe, Andrew Wadsworth, Iain McCulloch, and Ana C. Arias. Pulse oximetry using organic optoelectronics under ambient light. *Advanced Materials Technologies*, n/a(n/a):1901122, 2020. doi: [10.1002/admt.201901122](https://doi.org/10.1002/admt.201901122). URL <http://dx.doi.org/10.1002/admt.201901122>.

- [14] Donggeon Han, **Yasser Khan**, Karthik Gopalan, Adrien Pierre, and Ana C Arias. Emission area patterning of organic light-emitting diodes (oleds) via printed dielectrics. **Advanced Functional Materials**, 28(37):1802986, 2018. doi: [10.1002/adfm.201802986](https://doi.org/10.1002/adfm.201802986). URL <http://dx.doi.org/10.1002/adfm.201802986>.
- [15] Varun Soman, **Yasser Khan**, Madina Zabran, Mark Schadt, Paul Hart, Michael Shay, Frank Egitto, Konstantinos Papathomas, Natasha AD Yamamoto, Donggeon Han, Ana C Arias, Kanad Ghose, Mark D Poliks, and James N Turner. Reliability challenges in fabrication of flexible hybrid electronics for human performance monitors: A system level study. **IEEE Transactions on Components, Packaging and Manufacturing Technology**, 2019. doi: [10.1109/TCPMT.2019.2919866](https://doi.org/10.1109/TCPMT.2019.2919866). URL <http://dx.doi.org/10.1109/TCPMT.2019.2919866>.
- [16] Leeya Engel, Chengming Liu, Nofar Mintz Hemed, **Yasser Khan**, Ana Claudia Arias, Yosi Shacham-Diamand, Slava Krylov, and Liwei Lin. Local electrochemical control of hydrogel microactuators in microfluidics. **Journal of Micromechanics and Microengineering**, 28(105005), 2018. doi: [10.1088/1361-6439/aacc31](https://doi.org/10.1088/1361-6439/aacc31). URL <http://dx.doi.org/10.1088/1361-6439/aacc31>.
- [17] Abhinav M Gaikwad, **Yasser Khan**, Aminy E Ostfeld, Shishir Pandya, Sameer Abraham, and Ana Claudia Arias. Identifying orthogonal solvents for solution processed organic transistors. **Organic Electronics**, 30: 18–29, 2016. doi: [10.1016/j.orgel.2015.12.008](https://doi.org/10.1016/j.orgel.2015.12.008). URL <http://dx.doi.org/10.1016/j.orgel.2015.12.008>. Solvents visualization program is available in the Downloads section: <http://arias.berkeley.edu/downloads/>.
- [18] Aminy E Ostfeld, Abhinav M Gaikwad, **Yasser Khan**, and Ana C Arias. High-performance flexible energy storage and harvesting system for wearable electronics. **Scientific reports**, 6:26122, 2016. doi: [10.1038/srep26122](https://doi.org/10.1038/srep26122). URL <http://dx.doi.org/10.1038/srep26122>.
- [19] **Yasser Khan**, Hisham Al-Falih, Yaping Zhang, Tien Khee Ng, and Boon S Ooi. Two-step controllable electrochemical etching of tungsten scanning probe microscopy tips. **Review of Scientific Instruments**, 83(6): 063708, 2012. doi: [10.1063/1.4730045](https://doi.org/10.1063/1.4730045). URL <http://dx.doi.org/10.1063/1.4730045>.
- [20] Changxu Liu, Andrea Di Falco, D Molinari, **Yasser Khan**, Boon S Ooi, Thomas F Krauss, and Andrea Fratalocchi. Enhanced energy storage in chaotic optical resonators. **Nature Photonics**, 7(6):473, 2013. doi: [10.1038/nphoton.2013.108](https://doi.org/10.1038/nphoton.2013.108). URL <http://dx.doi.org/10.1038/nphoton.2013.108>. Cover article. Media coverage: [EurekAlert!](#), [nanowerk](#), [Photonics.com](#), [ScienceDaily](#), [Phys.Org](#), and many more.
- [21] Ali Moin, Andy Zhou, Abbas Rahimi, Alisha Menon, Simone Benatti, George Alexandrov, Senam Tamakloe, Jonathan Ting, Natasha Yamamoto, **Yasser Khan**, Fred Burghardt, Luca Benini, Ana C. Arias, and Jan M. Rabaey. A wearable biosensing system with in-sensor adaptive machine learning for hand gesture recognition. **Nature Electronics**, n/a(n/a), 2020. doi: [10.1038/s41928-020-00510-8](https://doi.org/10.1038/s41928-020-00510-8). URL <http://dx.doi.org/10.1038/s41928-020-00510-8>.
- [22] Alla M. Zamarayeva, Natasha A. D. Yamamoto, Anju Toor, Margaret E. Payne, Caleb Woods, Veronika I. Pister, **Yasser Khan**, James W. Evans, and Ana Claudia Arias. Optimization of printed sensors to monitor sodium, ammonium, and lactate in sweat. **APL Materials**, 8(10):100905, 2020. doi: [10.1063/5.0014836](https://doi.org/10.1063/5.0014836). URL <http://dx.doi.org/10.1063/5.0014836>.
- [23] Sara Rachel Arussy Ruth, Vivian Rachel Feig, Min-gu Kim, **Yasser Khan**, Jason Khoi Phong, and Zhenan Bao. Flexible fringe effect capacitive sensors with simultaneous high-performance contact and non-contact sensing capabilities. **Small Structures**, n/a(n/a):2000079, 2020. doi: [10.1002/sstr.202000079](https://doi.org/10.1002/sstr.202000079). URL <http://dx.doi.org/10.1002/sstr.202000079>.
- [24] Jonathan Ting*, Natasha Yamamoto*, **Yasser Khan***, and Ana C Arias. Screen-printed nickel oxide thermistor arrays. 202X. In preparation.

- [25] **Yasser Khan**, Matthew L. Mauriello, Parsa Nowruzi, Akshara Motani, Grace Hon, Nicholas Vitale, Jinxing Li, Jayoung Kim, Amir Foudeh, Dalton Duvio, Erika Shols, Megan Chesnut, James Landay, Jan Liphardt, Leanne Williams, Keith D. Sudheimer, Boris Murmann, Zhenan Bao, and Pablo E. Paredes. Design considerations of a wearable electronic-skin for mental health and wellness: balancing biosignals and human factors. **bioRxiv**, 2021. doi: 10.1101/2021.01.20.427496. URL <https://www.biorxiv.org/content/early/2021/01/21/2021.01.20.427496>.
- [26] **Yasser Khan***, Jayoung Kim*, Megan Chesnut*, Nicholas Vitale, Sahar Harati, Matthew L. Mauriello, Parsa Nowruzi, Jinxing Li, Min gu Kim, Jan Liphardt, Keith D. Sudheimer, Pablo E. Paredes, Leanne Williams, Boris Murmann, and Zhenan Bao. MentaId: a skin-inspired wearable for decoding mental health. 202X. **In preparation**.
- [27] **Yasser Khan***, Quentin Thiburce*, Scott Keene*, Nicholas Vitale, Hongping Yan, Jan Liphardt, Boris Murmann, Alberto Salleo, and Zhenan Bao. Organic electrochemical transistor-based wearable sweat sensing system. 202X. **In preparation**.
- [28] Alex Abramson, Carmel Chan, **Yasser Khan**, Alana Mermin-Bunnell, Naoji Matsuhisa, Robyn Fong, Rohan Shad, William Hiesinger, Parag Mallick, Sanjiv Sam Gambhir, and Zhenan Bao. A flexible electronic strain sensor for the real-time monitoring of tumor progression. **Science Advances**, 2022. doi: 10.1126/sciadv.abn6550. URL <http://dx.doi.org/10.1126/sciadv.abn6550>. **Media coverage: USC News, Stanford News, Georgia Tech News, and many more.**