

LI-KAI (ANDER) LIN, PhD, MS, MS

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Hardcoded Website: <https://linnps.github.io/cv2020/index.html>

SEMICONDUCTOR ✉ PROGRAMMING ✉ MATERIAL SCIENCE/BIO MEDICAL ENGINEERING ✉ RESEARCH & ANALYSIS

Accomplished, versatile bilingual Research & Development Engineer highly regarded for 16 years of experience in semiconductor, biomedical, nanotechnology engineering, and computer science fields. Seasoned in academic research and accustomed to leading projects that produce cutting-edge commercial products. Strong communicator who is able to translate stakeholder requirements into actionable objectives for a skilled team to complete on time and under budget. Academic qualifications include a Doctor of Philosophy in Materials Engineering with a 4.0 GPA from Purdue University.

CORE COMPETENCIES

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|--------------------------------|----------------------------|----------------------------------|
| ▪ Semiconductor Processing | ▪ Biomedical Engineering | ▪ Integrated Circuit Fabrication |
| ▪ Project Management | ▪ Microbiological Research | ▪ Electron Microscopy Spec. |
| ▪ Material Science Engineering | ▪ Data Processing | ▪ Cross-Collaboration |
| ▪ Programming Languages | ▪ Point of Care Research | ▪ Reporting/Presentations |

EDUCATION

Purdue University, West Lafayette, IN, USA: 2019

Doctor of Philosophy (PhD) – Materials Engineering (Overall GPA: 4.0/4.0) (Specialized in semiconductor and biosensor fab.)

- **Major project 1 (electrical):** SMART thin film Consortium (pre-manufacture R&D research team) (for the requests from Industry partners: United Technologies, Applied Materials, Eli Lilly, and the Battery Innovation Center):
 - Fabricated and analyzed metallic traces (electrodes), flexible circuits (substrates: Kapton and PET), and *organic field effect/thin film transistors* (OFETs/OTFTs) in Class 1 (ISO 3) clean room (Purdue) and performed electrical characterization and defect identification.
 - Designed and developed layer-by-layer MOSFETs and BGBC OFETs/OTFTs, including the thin film deposition of metallic (gate, source, and drain electrodes) and dielectric films (gate dielectric) using traditional lithography (oxidation, lithography, etching, and metallization) and new approaches (inkjet printing, screen printing techniques, roll to roll (R2R), and ultrafast laser sintering systems).
 - Performed electrical characterization (resistivity, mobility, carrier concentration) of semiconductor, including Hall effect analysis, I-V, and CV profiling using a probe station equipped with a semiconductor analyzer.
 - Performed quality analyses and thin film characterization using FIB cross-sectioning (organic semiconductor/source and drain/dielectric/gate), FEG-TEM, EDS, STEM, AFM, profilometer, XRD, and XPS.
 - Performed defect identification of circuits and transistors using OM and SEM.
 - Completed numerous cooperation across teams for PCB sensor board design and fabrication (portable resistance sensors), the investigation of thin-film mechanical properties (nanoindenter), image processing for metallic patterns, and electrical simulations (finite element model) of the fabricated thin-films.
 - Designed, executed and analyzed innovative experiments/ scientific research necessary to meet the requirements and engineering specifications from customers and the consortium.
- **Major project 2 (biomedical/electrochemical/biological):** grant programs: NIAID(R61AI40474), NSF(DGE-1333468), USDA (8072-42000-077-00D), and Bill & Melinda Gates Foundation: portable biosensors (electrochemical and microfluidic) for the detection of inflammation markers/Cancer (Matrix metalloproteinase 9, MMP-9), viruses (HIV), small molecule and heavy metal/contaminants (Hg^{2+} and BPA), and bacteria (E. Coli) as well as the study of Parkinson's disease (PD) from alpha-synuclein (A53T):
 - Performed biosensor (MMP-9/Cancer, HIV, Hg^{2+} , BPA, E. Coli) fabrications with the handling and treatment of antibody IgG, ssDNA aptamers, collagenase, HIV viral particles, human blood cells, bacteria, blocking agents, and various haptens.
 - Synthesized polymer-functionalized inorganic nanoprobe conjugated with biological components (IgGs and aptamers) to increase the stability and decrease the limit of detection of electrochemical and microfluidic sensing.
 - Printed and developed nondegradable resistive microheaters with nanosilver ink for improved methods of automated sample heating in point-of-care (POC) and in-field diagnostics to demonstrate both isothermal nucleic acid amplification at 65 °C and bacterial culture at 37 °C.
 - Developed a point-of-care microfluidic rapid and autonomous analysis device (microRAAD), including vitrified amplification reagents, thermally-actuated valves for fluidic control, and a temperature control circuit for low-power heating, that automatically detects HIV RNA from whole blood.

- Performed morphology observation of alpha-synuclein and phospholipids for the effects of neurotoxicity and investigated the potential causes of Parkinson's disease through the variation of mouse/human alpha-synuclein and various human-mouse chimeras using negative staining, TEM, and cryo-EM.
- Performed characterization for fabricated biosensors using CV, PEIS, electrophoresis, HPLC, FTIR, Raman (SERS), ELISA, and LFAs. (Cyclic Voltammetry, Impedance spectroscopy)
- Led ten-person team to finish all missions across projects and fabricated more than ten biosensors within four years.
- Fabricated biosensors with novel approaches and led to prestigious publications and a selected journal cover.
- **Relevant Coursework:** Semiconductor devices, Semiconductor Physics, Transistor: Field Effect Transistor and Bipolar Junction Transistor, Soft Materials (including flexible electronics), Microstructural Characterization Techniques, Biosensor Fabrications, Polymer Science, Biomaterials Applications.
- **Awards/Honors:** Golden Key Honor Society Chapter at Purdue (Top 15%), 1st place in MSE Qualification Examination 2015, personal scientific illustration was selected by Small journal as their **cover image** (Impact factor **11.459**), the scientific article was chosen by Wiley-VCH to be the hottest research.

University of Southern California, Los Angeles, CA, USA: 2015 (*Specialized in semiconductor*)

Master of Science – Materials Engineering (Major GPA in Materials Science: 3.9/4.0; Overall GPA: 3.6)

- **Relevant Coursework:** Integrated Circuit Processing, Solid State Processing, Integrated Circuits fabrication, Modeling and Analysis of Chemical Engineering Systems
- **Project:** performed MOSFETs (NMOS, PMOS), diodes, capacitors, and resistors fabrication from a bare silicon wafer with the fabrication technology (Thermal oxidation, lithography with HMDS and photoresist, etching with HF and NH₄F, and metallization with e-beam) in a Class 100 (ISO 5) cleanroom and performed IC defect identification and IC electrical characterization (I-V and CV profiling).
- **Clubs/Activities:** Private Equity and Venture Capital Club (Co-Founder), Taiwanese Student Association (Board Member), Taiwanese American Chamber of Commerce of Greater Los Angeles – Junior Chapter (Committee Member)

National Cheng Kung University, Tainan, Taiwan: 2009 (*Specialized in nanostructure fabrication*)

Master of Science – Nanotech and Microsystems Engineering (Overall GPA: 4.0/4.0)

- **Awards/Honors:** Phi Tau Phi Scholastic Honor Society (1st Place), Thesis Poster Competition (Honorable Mention)
- **Project:** nanostructure fabrication for SERS sensor development in a class 1000 (ISO 6) cleanroom.

National Cheng Kung University, Tainan, Taiwan: 2007 (*Overall GPA in Materials Science: 3.8/4.0; Overall GPA: 3.5*)

1st and 2nd (Double Major) Bachelor of Science – Materials Science and Engineering, Civil Engineering (~200 credits)

- **Awards/Honors:** Top Ten Scholar Award in the undergraduate program in academic performance

PROFESSIONAL EXPERIENCE

Birck Nanotechnology Center ✦ Purdue University ✦ West Lafayette, IN, USA ✦ 2015 – 2019

Research Scientist, SMART thin film consortium pre-manufacture R&D research team

- Worked with more than 20 top professors/teams from various departments (EE, BME, ME, and MSE) at Purdue University and partnered with industrial companies toward the goal of developing thin film applications and commercial products.
- Fulfilled the requests from industry partners to develop the prototypes of novel commercial products before each strict deadline (two terms per year: April and Nov.), displayed, and presented research achievements in Industry Days at the end of each term (April and Nov.) to industry partners.
- Projects: **(11/2015:)** basic flexible electronics on PET phase 1, Small molecule contaminant and bacteria detection phase 1 **(11/2016:)** basic flexible electronics on PET phase 2, Small molecule contaminant and bacteria detection phase 2 **(11/2016:)** basic flexible electronics on Kapton phase 1, Inflammation marker and heavy metal detection phase 1 **(4/2017:)** OFETs on Kapton phase 1, Inflammation marker and heavy metal detection phase 2, neurotoxicity research phase 1, HIV detection phase 1 **(11/2017:)** OFETs on Kapton phase 2, Inflammation marker and heavy metal detection phase 3, neurotoxicity research phase 2, HIV detection phase 2 **(4/2018:)** OFETs on Kapton phase 3, Inflammation marker and heavy metal detection phase 4, neurotoxicity research phase 3, HIV detection phase 3 **(11/2018:)** OFETs application phase 1, Inflammation marker detection phase 5, pesticide detection phase 1, neurotoxicity research phase 4, HIV detection phase 4, printed microheater phase 1 **(4/2019:)** OFETs application phase 2, neurotoxicity research phase 5, HIV detection phase 5, printed microheater phase 2

Taiwan Semiconductor Manufacturing Company (TSMC), Ltd. ✦ Hsinchu, Taiwan ✦ 2017

Intern, Advanced Tool and Module Development Division, Research and Development

- Researched and developed thin film and metal gate (MG), and Tungsten deposition for 7 nm process. (W/TiN/SiO₂/Si)
- Improved tungsten film uniformity by 40% and range reduction by 40%.
- Participated to the Installation of new manufacturing facilities with vendors and qualified their manufacturing capacity.

- Optimized dual zone heater within wafer nucleation % and range of MG fill tungsten with new heating element design.
- Evaluated and optimized CIP hardware, playing a pivotal role in hardware setup and achieving Tier I schedule.
- Optimized tungsten ALD (nucleation) and CVD (bulk) coating process with various parameters (gas injection: Ar, WF₆, H₂).
- Investigated temperature tuning window at different zone ratio settings.
- Measured and analyzed heat distribution on wafer during tungsten CVD/ALD process using in-situ wireless sensor wafer, instrumented wafer for process temperature monitoring.
- Performed Base Station 300Z, wafer viewer, and Thermal Map 3 operations.
- Analyzed tungsten thin film morphology using an ellipsometer; measured, calculated, and studied tungsten thin-film thickness and resistivity.
- Nominated to be top ten TSMC interns within 145 interns in the internship final run research competition.

**Health One Pharmaceuticals, Inc. (now "Ascent America Laboratories") ✦ City of Industry, CA, USA ✦ 2014
Intern, Testing Lab**

- Established and developed SOPs for eight new medicine packaging systems/product lines to standardize product manufacturing sequences.
- Performed E. coli, Enterobacteriaceae, and staph tests to examine and prevent contaminated medicines.
- Executed component analyses to ensure products contained intended components using FTIR and HPLC.
- Performed chemical analyses, quality analyses, quality controls, and product line controls to reduce defective products.

**Golden Hardpoint, Inc. ✦ Taipei, Taiwan ✦ 2010 – 2012
Application Engineer**

- Advised super alloy machining and tooling test support on correcting product manufacturing issues.
- Completed technical seminar to exhibit products, boring, drilling, reaming, threading, and porting systems to customers.
- Delivered technical support for product properties, usages, and issues to maximize customer service efforts.
- Conducted consumption market analyses to raise consumer purchasing intentions to boring systems.
- Served as a technical manager to supervise a team of five engineers in providing various technical support.

**NCKU Nanotechnology Center ✦ National Cheng Kung University ✦ Tainan, Taiwan ✦ 2003 – 2009
Research Assistant/Administrative Assistant**

- Fabricated nanostructures on gold-coated silicon wafer using multiple cleanroom techniques and nanoindenter.
- Designed and developed nano-components for metal-based biochips with SERS techniques to detect virus and completed National Program on Nanotechnology grant subproject using SERS-active substrates for virus sensor fabrication.
- Conducted Industrial Technology Research Institute (ITRI) grant subproject using microcontact nanoimprint technique and ion-implantation technique with Metal Vapor Vacuum Arc (MEVVA) ion source.
- Fabricated SERS biosensors and studied intensive biomaterials using advanced structure-making techniques.
- Fabricated ion-implanted titanium nitride using metal vapor vacuum arc technique and performed analyses of ion-implanted titanium nitride microstructure and studied the microstructure using OES and XPS.
- Executed metal and alloy surface polishing and contact angle test to analyze metal and alloy surface properties.
- Conducted 3D model construction to fabricate draft of building structures using CAD.

PUBLICATIONS (Total publications: 20 articles/4 years (Including 5 submitted papers))

Google Scholar: https://scholar.google.com/citations?hl=zhTW&user=Dox1V54AAAAJ&view_op=list_works&sortby=pubdate

Featured publications:

- **Li-Kai Lin** et al. "Cost-Effective Methods to Nanopattern Thermally Stable Platforms on Kapton HN Flexible Films Using Inkjet Printing Technology to Produce Printable Nitrate Sensors, Mercury Aptasensors, Protein Sensors, and Organic Thin Film Transistors," *ArXiv*. (Preprint)
- (Submitted) "The influence of Bi₂O₃ glass powder in silver paste and its effectiveness in integrated circuits on silicon substrates".
- Natalie Landeck, Katherine E. Strathearn, Daniel Ysselstein, Kerstin Buck, Aswathy Chandran, Sayan Dutta, John D. Hulleman, Jagadish Hindupur, Amy M. Griggs, Siddhartha Banerjee, Zhengjian Lv, **Li-Kai Lin**, Sonal Padalkar, George P. McCabe, Lia A. Stanciu, Yuri L. Lyubchenko, Deniz Kirik, and Jean-Christophe Roche, "Two C-terminal sequence variations determine differential neurotoxicity between human and mouse α -synuclein," 2020. (Accepted by **Molecular Neurodegeneration**) (IF: 9.599)
- Susana Díaz-Amaya, Min Zhao, **Li-Kai Lin**, Carlos Ostos, Jan P Allebach, George T-C Chiu, Amanda J Deering, Lia A Stanciu, "Bio-Nanopatterning: Inkjet Printed Nanopatterned Aptamer-Based Sensors for Improved Optical Detection of Foodborne Pathogens", *Small*, 2019. (IF: 11.459) (personal scientific illustration - SCI paper cover)
- Susana Díaz-Amaya, **Li-Kai Lin**, Renee E. DiNino, Carlos Ostos, Lia A Stanciu, "Inkjet printed electrochemical aptasensor for detection of Hg²⁺ inorganic solvents", *Electrochimica Acta*, 2019. (IF: 6.215) (SCI paper)
- Elizabeth A Phillips, ..., **Li-Kai Lin**, Lia A Stanciu, Jacqueline C Linnes, "Microfluidic Rapid and Autonomous Analytical Device (microRAAD) to Detect HIV from Whole Blood Samples", *Lab on a Chip*, 2019. (IF: 6.9) (SCI paper)

- **Li-Kai Lin**, Lia A Stanciu “Bisphenol A detection using gold nanostars in a SERS improved lateral flow immune-chromato-graphic assay”, *Sensors and Actuator B: Chemical*, Vol. 276, pp 222-229, 2018. (IF: 7.1) (SCI paper)
- **Li-Kai Lin**, Aytekin Uzunoglu, Lia A Stanciu, “Aminylated and thiolated PEG-covered gold nanoparticles with high stability and anti-aggregation for lateral flow detection of bisphenol A”, *Small*, 2017. (IF: 11.459) (SCI paper)

TECHNICAL SKILLS	
APPLICATIONS	Origin, Matlab, ImageJ, Office 365 suite, Mendeley, Endnote
IDE	IntelliJ, jGRASP, Visual Studio, VS Code, Atom
INDUSTRY SOFTWARE	(Semiconductor:) SiView (manufacturing execution system), Wafer viewer, Thermal Map 3
ILLUSTRATOR	Adobe (PhotoShop CC, Illustrator CC), ChemDraw, Clip Studio Paint Pro
CAD	(CAD:) Solidworks, AutoCAD, CorelCAD
LAB TECHNIQUES	<p>(Semiconductor and nanofabrication:) Wafer cleaning, cutting and handling, foup handling and identification (FEOL-transparent, BEOL-green/red), FEOL, RCA clean (H₂NO₄, NH₄OH, HF, H₂O₂...), masking, RIE, nanoindentation techniques, hot embossing/UV-curing nanoimprint, plasma cleaning and curing techniques.</p> <p>(General and Bio:) Applications of colloidal metals, antibody applications, primer and aptamer applications, serum albumin and buffer solution applications, binding, surface blocking, and washing techniques, protein separation and purification techniques, immuno techniques, ELISA, cell Culture, aseptic techniques, western blot, blood smear staining/mounting</p>
EQUIPMENT	<p>(Semiconductor and nanofabrication:) Applied Materials SEMvision G4 and G6 platforms, profilometer, ellipsometer, SMIF, E-Beam, spin coater, CVD, PVD, ALD, mask aligner, micro-plasma, microwave asher, CSAM, XPS, XRD, XRF,TGA, DMA, focused ion beam (FIB) and electron beam system, inkjet printing nanofabrication system, R2R system, AFM, nanoindenter, ultrafast laser, probe station, semiconductor analyzer, overhead hoist transfer (OHT) system, multimeter, waveform generator</p> <p>(General and Bio:) Spectrometer equipment (FTIR, UV-Vis, Raman), Pipettes, microfluidic/lateral flow assays, centrifuge, pH meter, zetasizer, tissue culture ware (flasks, petri dishes, conical flask), incubators (37°C, 5% CO₂), optical microscope, oil lense, surface area and porosity instruments, gas pycnometer, coulter counter, contact angle meter, confocal nano focus microscopy, BET, electrophoresis chamber system, cell counter, sonicator</p>
ELECTRON MICROSCOPY	SEM/EDX, TEM/EDX, STEM, cryo-EM
OS AND PROGRAMMING	C, C++, C#, Java, Python, HTML, CSS, JavaScript, SQL, Scratch, Fortran, Linux, Windows, OS X.
SEMICONDUCTOR PROCESSING	Thermal oxidation of silicon, photolithography, thin film deposition, diffusion, etching, assembly, packaging, LBL growth of semiconducting materials, plasma etch, plasma deposition, electroplating, metal gate Tungsten thin film optimization, FIB and TEM thin film cross section analyses, circuit SEM image analyses, electrical characterization with probe station and semiconductor analyzer, OTFT, MOSTFETs fabrication.
ADDITIONAL CREDENTIALS	
LANGUAGES	English – Full professional proficiency, Mandarin Chinese – Native proficiency (Excellent Communication)
PROFESSIONAL DEVELOPMENT	<ul style="list-style-type: none"> ▪ Certified SEM, TEM, Titan Environmental STEM, and Cryo-EM Specialist (Purdue) ▪ Integrated Circuit Processing, Solid State Processing, and Integrated Circuits labs (USC) ▪ cell culture training (Purdue and ThermoFisher)
PROFESSIONAL CERTIFICATE AND BADGE	Electronics Foundations: Fundamentals, Electronics Foundations: Semiconductor Devices, Semiconductor Physics, Material Processing, Data Integrity (NSF), Java: Data Structure, Six Sigma, Cell Culture (Gibco Education/ThermoFisher)
ORGANIZATIONS	<ul style="list-style-type: none"> ▪ National Society of Professional Engineers – Member ▪ Institute of Electrical and Electronics Engineers (IEEE) – Member ▪ Materials Research Society – Member
VOLUNTEERING EXPERIENCE	<ul style="list-style-type: none"> ▪ Department of Biology, Geology & Physical Sciences, Sul Ross State University, TX, USA, 2020 (Researcher) Immune response varies with rate of dispersal in invasive cane toads. ▪ Taiwanese-American Chamber of Commerce of Greater Los Angeles, CA, USA, 2013-2015: (Board member and Representative for USCTSA) exchange opinions with managers in CA. ▪ Annual Conferences of World Taiwanese Chambers of Commerce (WTCC), CA, USA, 2014 and 2015: (PR manager) exchange opinions about business with managers in US.