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Ting-Hsuan Chen

Smart Wearable Device | Thermoregulation | Photonics

Profile: tinghsuanchen.com
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Summary

- Materials scientist with 5+ year interdisciplinary experience in **photonics, heat transfer**, and **wearable device engineering**
- Experienced in **wave-matter interaction** and the correlation among polymer synthesis condition, structural characterization, charge transport, permittivity measurement, metamaterial absorber designs, and heat transfer
- Experienced in **academic and industrial collaboration** by driving deliverables and projects with Sony and Cambrios Inc.

Education

Duke University, *PhD Candidate in Mechanical Engineering and Materials Science* — Expected May 2024
Advisor: Dr. Po-Chun Hsu
Duke University, *concurrent M.S. in Electrical and Computer Engineering*
National Taiwan University, *B.S. in Materials Science and Engineering* — Sept. 2014 — June 2018

Skills

Simulation/Programming	COMSOL Multiphysics, Python, MATLAB, LabView, C/C++, LaTeX
Characterization	SEM, TEM (including STEM, EELS, SAED), FTIR, UV-Vis, Raman/PL, ellipsometry, XRD, profilometer
Lab/Fab	CVD, Evaporation, Sputtering, Electrochmistry (Voltamperometric techniques, Impedance spectroscopy, etc.), Spin-coating, Lithography, Wet etching, Reactive ion etching

Research Experience

Duke University, PhD Candidate — **Sept. 2019 — Present**
Dept. of Mechanical Eng. and Materials Sci., Lab of Dr. Po-Chun Hsu — *Durham, NC*

Project: Wearable Variable Emittance Device (WeaVE)
- Devised and realized a new scheme of energy-efficient wearable personal thermoregulation device, leading to a first-author paper under review at Nature Electronics (preprint link)
- Demonstrated variable radiative transfer device by using **electrochromic conductive polymer**, expanded thermal comfort zone by 5 °C and decreased the energy consumption by four orders of magnitude compared to traditional electric heater
- Built **engineering prototype** of autonomous personal thermoregulation systems by Arduino circuitry, sensors and device
- Fabricated organic electronic device by integrating **electrochemical synthesis, optical characterization** and **kinetics**
- Collaborated with team of researchers to design kirigami patterns by performing **mechanical testing** and **FEM analysis**
- Designed, constructed and installed a heat transfer measurement chamber with **temperature PID control** by **LabView**

Project: Electrochemically Tunable Thermal Metasurface
- Designed the configuration and simulated the optical response of metamaterial absorber by **COMSOL**
- Performed **spectroscopic ellipsometry** measurement and fitting with complex dielectric dispersion relations
- Developed thin-film process, e.g. **sputter, evaporation, dry/wet etching, spin-coating**, etc. for dynamic metasurface

National Taiwan University, Research Assistant — **July 2017 — Aug 2019**
Center of Condensed Matter Sciences, Advanced Materials Lab — *Taipei, Taiwan*

Project: BiCuTeO-based Thermoelectric Material
- Identified defects and analyzed phases of thermoelectric materials, leading to a 2nd-author paper at Materials Today Physics
- Utilized **TEM** and **STEM** for characterization (lattice images, selected area electron diffraction, element mapping, line scan, etc.) with more than 300 hrs experience. Some specimens include: BiCuTeO, SnS_2 , carbon nanotubes, ZnS, etc.

Project: Selective Heterojuction Photocatalyst for CO_2 Reduction
- Designed hydrothermal processes for different solution and enhanced heterojunction of photocatalysts and observed the morphology using SEM
- Participated in installing gas chromatograph and constructed calibration curve for measuring quantum efficiency

Publication

3. T.-H. Chen, Y. Hong, C.-T. Fu, A. Nandi, W. Xie, J. Yin, P.-C. Hsu (2022), "A Kirigami-enabled Electrochromic Wearable Variable Emittance (WeaVE) Device for Energy-Efficient Adaptive Personal Thermoregulation" *Under review at Nature Electronics*, preprint DOI: 10.21203/rs.3.rs-1420619/v1
2. C. Sui, J Pu, T.-H. Chen, Y.-T. Lai, Y. Rao, X. Li, J. Liang, V. Viswanathan, P.-C. Hsu, "Aqueous electrolyte and Pt-modified graphene for high-performance dynamic mid-infrared radiative heat management" *In progress*
1. H.-C. Chang, T.-H. Chen, R. Sankar, Y.-J. Yang, L.-C. Chen, K.-H. Chen (2020), "Highly improved thermoelectric performance of BiCuTeO achieved by decreasing the oxygen content", ***Materials Today Physics***, DOI: 10.1016/j.mtphys.2020.100248