

Chien-Hua TU, Ph.D.

Postdoctoral Research Scholar

Department of Materials Science and Engineering

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EDUCATION

Max Planck Institute for Polymer Research (Mainz, Germany) July 2018 – Dec 2021

Ph.D. Chemistry

Honors/Awards: Graduate with *Magna Cum Laude*

APS Frank J. Padden Jr. Award in Polymer Physics – Finalist (2021)

- This award is conferred by the Division of Polymer Physics (DPOLY) in American Physical Society (APS) for celebrating the graduate student with excellence in Polymer Physics research.

National Cheng Kung University (Tainan, Taiwan) Sep 2015 – Jul 2017

M.S. Chemical Engineering

GPA: 4.3/4.3 (rank top 1% in the class)

Honors/Awards: *Phi Tau Phi* Scholastic Honor Society (Taiwan) (2017)

Travel Scholarship — Ministry of Science of Technology (MOST) EPF conference (Lyon) (2017)

Merit Award — Oral presentation competition (English), polymer society (Taiwan) (2017)

TASCO Chemical Corporation Scholarship (Taiwan) (2016)

National Cheng Kung University (Tainan, Taiwan) Sep 2011 – Jun 2015

B.S. Chemical Engineering

GPA: 3.91/4.0 (rank top 1% in the class)

Honors/Awards: Award of Outstanding Student in Graduate Program of Engineering College (top 1%) (2015)

Award of Outstanding Student for Academic Achievement (top 10%) (NCKU) (2012 – 2013)

Award of Outstanding Student for Academic Achievement (top 10%) (NCKU) (2011 – 2012)

RESEARCH EXPERIENCE (Most of the projects involved contribute to publications, see *PUBLICATION* section.)

University of Pennsylvania, Postdoctoral Research Scholar | Philadelphia, PA Jan 2023 – present

Lab of Prof. Dr. Karen I. Winey

- ❖ Project 1: Characterization of novel polymers via chemical upcycling reactions of polyolefin waste resemblance
 - Techniques involved: Electrochemical Impedance Spectroscopy (EIS), Dielectric Spectroscopy (DS), SAXS, WAXS, FTIR, DSC, Lap Join Shear, DMA, hot pressing
- ❖ Project 2: Single polymer chain properties (M_w , R_g , A_2) by static- and dynamic light scattering in ambient and at high temperatures
 - Techniques involved: Light scattering, Abbe Diffractometer

Georg August University Göttingen, Postdoctoral Fellow | Goettingen, Germany Jan 2022 – Oct 2022

Lab of Prof. Dr. Jörg Enderlein

- ❖ Project: Development of advanced single molecule fluorescence correlation spectroscopy to investigate conformational dynamics of biomolecules
 - Techniques involved: Fluorescence Correlation Spectroscopy (FCS), Fluorescence Lifetime Imaging Microscopy (FLIM), metal-induced energy transfer (MIET), DNA origami, fluorescence labeling

Max Planck Institute for Polymer Research, PhD Graduate Researcher | Mainz, Germany Jul 2018 – Dec 2021

Lab of Prof. Dr. George Floudas and Prof. Dr. Hans-Jürgen Butt

- ❖ Project 1: Development of in situ nanodielectric techniques to study polymer chain behavior inside nanopores
 - Techniques involved: Broadband Dielectric Spectroscopy (BDS), SEM, Rheology, DSC, anodic aluminum oxide (AAO) nanopores, chemical etching, metal sputtering, static- and dynamic contact angle, surface tension
- ❖ Project 2: Investigate the polymer dynamics of homopolymer and polymer blends in situ during imbibition within nanopores
 - Techniques involved: In situ nanodielectric spectroscopy (self-developed), the rest are the same in project-1
- ❖ Project 3: Investigate the cooperative motion between ions and polymer chains in situ during imbibition within nanopores

- Techniques involved: In situ nanodielectric spectroscopy (self-developed), Time-of-Flight Secondary Ion Mass Spectrometry (ToF SIMS), the rest are the same in project-1
- ❖ Project 4: Challenge the infiltration of semicrystalline polymer into nanopores at temperature below melting point
- Techniques involved: SEM, AFM, AFM-IR (Nano-IR), Rheology, DSC, contact angle, surface tension, anodic aluminum oxide (AAO) nanopores

National Cheng Kung University, Master Graduate Researcher | Tainan, Taiwan

Sep 2015 – July 2017

Lab of Prof. Eamor Woo

- ❖ Project: Investigate the crystallization mechanism of ring-banded spherulites in aromatic polyesters
- Techniques involved: Polarized Optical Microscopy (POM), AFM, SEM, FTIR, DSC

INDUSTRY EXPERIENCE

Taiwan Semiconductor Manufacturing Company (TSMC) Process Engineer | Tainan, Taiwan Aug 2017 – Jun 2018

- Root-cause finding and maintaining the stability of chemical mechanical polishing (CMP) process.

PUBLICATION

Journal:

1. **Tu, C.-H.**; Chethalen, R.J.; Fastow, E.; Papamokos, G.; Coughlin, E.B.; Winey, K.I. "Distinctive relaxation behavior in associating polymers" **2023** (drafted).
2. Ogbu, M.I.*; **Tu, C.-H.***; Winey, K.I.; Kozłowski, M. "Ketone functionalization of polycyclooctene" **2023** (in preparation).
3. Antenucci, P.M.J.*; **Tu, C.-H.***; Winey, K.I.; Kozłowski, M. "Dihydroxylation of polypolycyclooctene" **2023** (in preparation).
4. Radzanowski, A.N.*; **Tu, C.-H.***; Winey, K.I.; Coughlin, E.B. "Functionalization of unsaturated polyolefins via hydroboration/oxidation" **2023** (in preparation).
5. **Tu, C.-H.**; Steinhart, M.; Berger, R.; Kappl, M.; Butt, H.-J.; Floudas, G. "When crystals flow" *Science Advances* **2023**, 9, eadg8865. => *Selected as Front Cover*
6. **Tu, C.-H.**; Veith, L.; Butt, H.-J.; Floudas, G. "Ionic conductivity of a solid polymer electrolyte confined in nanopores" *Macromolecules* **2022**, 55 (4), 1332-1341.
7. **Tu, C.-H.**; Zhou, J.; Butt, H.-J.; Floudas, G. "Adsorption kinetics of *cis*-1,4-polyisoprene in nanopores by *in situ* nanodielectric spectroscopy" *Macromolecules* **2021**, 54 (13), 6267-6274.
8. Ye, L.; Ji, H.; Liu, J.; **Tu, C.-H.**; Kappl, M.; Koynov, K.; Vogt, J.; Butt, H.-J. "Carbon nanotube-hydrogel composites facilitate neuronal differentiation while maintaining homeostasis of network activity." *Advanced Materials* **2021**, 2102981.
9. Woo, E.M.; **Tu, C.-H.**; Nagarajan, S.; Lugito, G. "In-situ growth of nucleus geometry to dual types of periodically ringed assemblies in poly(nonamethylene terephthalate)." *Crystals* **2021**, 11, 1338.
10. **Tu, C.-H.**; Woo, E.M.; Nagarajan, S.; Lugito, G. "Sophisticated dual-discontinuity periodic bands of poly(nonamethylene terephthalate)." *CrystEngComm*, **2021**, 23, 892-903.
11. **Tu, C.-H.**; Zhou, J.; Doi, M.; Butt, H.-J.; Floudas, G. "Interfacial interactions during *in situ* polymer imbibition in nanopores" *Physical Review Letters* **2020**, 125 (12), 127802.
12. **Tu, C.-H.**; Steinhart, M.; Butt, H. J.; Floudas, G. "*In situ* monitoring of the imbibition of poly(*n*-butyl methacrylate) in nanoporous alumina by dielectric spectroscopy" *Macromolecules* **2019**, 52 (21), 8167-8176.
13. **Tu, C.-H.**; Woo, E. M.; Lugito, G. "Structured growth from sheaf-like nuclei to highly asymmetric morphology in poly(nonamethylene terephthalate)." *RSC Adv.* **2017**, 7 (75), 47614-47618.

Book chapter:

14. **Tu, C.-H.**; Steinhart, M.; Butt, H.-J.; Floudas, G. "Polymers under 2-D confinement: flow of polymer melts at the nanoscale" *ACS Symposium Series – Broadband Dielectric Spectroscopy: A Modern Analytical Technique*; American Chemical Society: Washington, DC, **2021**, Chapter 9, 203-221.
⇒ Invited by Division of Analytical Chemistry in American Chemical Society (ACS).

CONFERENCE

1. "Decoupled Main-Chain Backbone and Sticky-Group Dynamics in Associating Comb Polymers by Dielectric Spectroscopy" Virtual Polymer Physics Symposium **2023** (sponsored by Division of Polymer Physics in American Polymer Physics) (invited talk)
2. "Investigating Polymer Chain Dynamics in Bulk and under Confinement by Broadband Dielectric Spectroscopy" The Chinese University of Hong Kong (CUHK) – Shenzhen Long Feng Science Forum **2022** (invited talk)

3. “*In Situ* Monitoring the Imbibition and Adsorption Kinetics of cis-1,4-polyisoprene in Nanopores by Nanodielectric Spectroscopy” International Dielectric Society (IDS) Online Workshop **2021** (Poster)
4. “*In Situ* Monitoring Polymer Imbibition in Nanopores by Nanodielectric Spectroscopy” APS March Meeting **2021** (invited – Padden Award Symposium).
5. “*In Situ* Monitoring the Imbibition of poly(*n*-butyl methacrylates) in Nanoporous Alumina by Nanodielectric Spectroscopy” ACS National Meeting, March **2020**, Philadelphia (cancelled due to outbreak of corona virus).
6. “Interior Analyses on Lamellar Assembly in Dual Types of Ring-banded Spherulites of Poly(nonamethylene terephthalate)”, Annual Meeting of Polymer Society, January **2017**, Taichung, Taiwan (oral).

OUTREACH EXPERIENCE

1. **Session Chair** March 2024 (forthcoming)
2024 APS March Meeting in Minneapolis (MN). Chair the session “*Surface, Interfaces, Thin Films, and Coatings*”.
2. **Outreach Coordinator** February 2023
Philly Materials Day, University of Pennsylvania and Drexel University
 - Collaborate with students, postdocs, and faculty at UPenn and Drexel Univ. to host a series of scientific demonstration open to the public nationwide.
3. **Guest Instructor** Jan – February 2023
Invited EIS/DS lectures, Department of Materials Science and Engineering, University of Pennsylvania
 - Delivered a series of lectures about the principles and applications of broadband dielectric spectroscopy (BDS) (or called electrochemical impedance spectroscopy, EIS) in soft matter to scientists from the Departments of Chem/ChE/MSE.
4. **Third Place** — Badminton Mixed Doubles — 4th Badminton Fun Cup (2022) (Germany)
5. **Third Place** — Badminton Man Doubles — 10th Friedberger Wetterau Cup (2022) (Germany)
6. **Third Place** — Badminton Mixed Doubles — 4th Karlsruhe Chinesischen Badminton Tournament (2022) (Germany)
7. **Second Place** — Badminton Man Doubles — 16th Hechtsheimer Badminton Tournament (2019) (Germany)