



## Education

### **Cornell University, NY**

PhD, Material Science and Engineering

**2019-Current**

### **Northwestern University, Evanston, IL**

Master of Science (M.S.), Material Science and Engineering (GPA: 4.0/4.0)

**2016-2017**

### **National Taiwan University, Taiwan**

Bachelor of Science (B.S.), Material Science and Engineering (GPA: 3.92/4.30)

**2012-2016**



## Research Experience

### **PhD Research Project**

**Sep. 2019 – Current**

#### **Thompson Lab, Cornell University**

- Developed probabilistic and physically-realistic X-ray diffraction (XRD) pattern demixing and labeling algorithm that outperforms current state-of-the-art methods while being extendible and easy to tune
- Demonstrated AI-enabled autonomous and user-interactive targeted material synthesis by combining active learning agent, automated laser spike annealing, high throughput thin film XRD and on-the-fly XRD pattern labeling
- Assisted the development of autonomous of active learning agent that can speed up phase map construction experiments by 70 times by stripe-specific kernel design and proper uncertainty propagation
- Implemented a physical layer in Deep Reasoning Network (DRNet) for more flexible XRD phase labeling and provide more physical interpretations of predicted crystal structures
- Committee: Prof. Michael O. Thompson (Chair), Prof. R. Bruce van Dover, Prof. Carla P. Gomes

### **Research Assistant**

**Aug. 2018 – Jun. 2019**

#### **Advanced Material Lab, Academia Sinica, Taiwan**

- Developed a technique to grow full-coverage MoS<sub>2</sub> single layer film with record-high grain size
- Provided transition metal dichalcogenide alloy for photoelectrochemical cells research
- Advisor: Dr. Kuei-Hsien Chen

### **Master Research Project**

**Dec. 2016 – Dec. 2017**

#### **Thermoelectric Lab, Northwestern University**

- Measured creep and thermoelectric properties of hot-pressed (GeTe)<sub>85</sub>(AgSbTe<sub>2</sub>)<sub>15</sub> (TAGS-85)
- Analyzed microstructure and phases of TAGS-85 with SEM, EBSD and TEM
- Measured physical properties of 3D-extruded composite thermoelectric threads with SEM
- Advisor: Prof. G. Jeffrey Snyder and Prof. David C. Dunand



## Relevant Skills

- **Programming Languages:** Python (5+ years), Julia (2+ years), C++ (1 year), Swift (1 year)
- **Technical skills:** Active learning, unsupervised learning, Gaussian process, optimization
- **Other CS related skills:** Linux, Git, object-oriented programming, functional programming
- **Thin film process:** Sputter, Evaporation, PEALD, CVD
- **Material analysis:** SEM, EBSD, EDS, XRD, XPS, XRF
- **Spectroscopy:** Raman spectroscopy, Time-resolved photoluminescence, UV-Visible spectroscopy



## Publications

1. **Chang, M. C.**, Min, Y., Kong, S., Gregoire, J. M., van Dover, R. B., Thompson, M. O., Gomes, G. P. (2023) Physically Informed Graph-based Deep Reasoning Net for Efficient Combinatorial Phase Mapping *22<sup>nd</sup> International Conference on Machine Learning and Application* (Co-first author)
2. Zhou, L., Shinde, A., **Chang, M. C.**, van Dover, R. B., Thompson, M.O., Gregoire, J. M. High throughput identification of complex rutile alloys for the acidic oxygen evolution reaction *Journal of Materials Chemistry A* 11.46 (2023): 25262-25267.
3. **Chang, M. C.**, Ament, S., Amsler, M., Sutherland, D., Gomes, C. P., van Dover, R. B., Thompson, M.O.(2023) Probabilistic multi-phase labeling framework for automating high-throughput XRD analysis. *arXiv:2308.07897*
4. Gann, K. R., Chang, C. S., **Chang, M. C.**, Sutherland, D. R., Connolly, A. B., Muller, D. A., Bruce Van Dover, R., Thompson, M. O. (2022). Initial nucleation of metastable  $\gamma$ -Ga<sub>2</sub>O<sub>3</sub> during sub-millisecond thermal anneals of amorphous Ga<sub>2</sub>O<sub>3</sub>. *Appl. Phys. Lett.* 121, 062102
5. Ament, S., Amsler, M., Sutherland, D. R., **Chang, M. C.**, Guevarra, D., Connolly, A. B., Gregoire, J. M., Thompson, M. O., Gomes, C. P., & van Dover, R. B. (2021). Autonomous materials synthesis via hierarchical active learning of nonequilibrium phase diagrams. *Science Advances*, 7(51).
6. Sutherland, D. R., Connolly, A. B., Amsler, M., **Chang, M. C.**, Gann, K. R., Gupta, V., Ament, S., Guevarra, D., Gregoire, J. M., Gomes, C. P., Bruce Van Dover, R., & Thompson, M. O. (2020). Optical Identification of Materials Transformations in Oxide Thin Films. *ACS Combinatorial Science*, 22(12), 887-894.
7. **Chang, M. C.**, Ho, P. H., Tseng, M. F., Lin, F. Y., Hou, C. H., Lin, I. K., ... & Chen, L. C. (2020). Fast growth of large-grain and continuous MoS<sub>2</sub> films through a self-capping vapor-liquid-solid method. *Nature Communications*, 11(1).
8. Peng, J., Witting, I., Geisendorfer, N., Wang, M., **Chang, M.**, Jakus, A., Kenel, C., Yan, X., Shah, R., Snyder, G. J., & Grayson, M. (2019). 3D extruded composite thermoelectric threads for flexible energy harvesting. *Nature Communications*, 10(1).
9. **Chang, M.**, Agne, M., Michi, R., Dunand, D., & Snyder, G. (2018). Compressive creep behavior of hot-pressed GeTe based TAGS-85 and effect of creep on thermoelectric properties. *Acta Materialia*, 158, 239-246.



## Conference Presentations

1. **Chang, M. C.**, Min, Y., Kong, S., Gregoire, J. M., van Dover, R. B., Thompson, M. O., Gomes, G. P. Physically Informed Graph-based Deep Reasoning Net for Efficient Combinatorial Phase Mapping *22<sup>nd</sup> International Conference on Machine Learning and Application*
2. **Chang, M. C.**, Ament, S., Amsler, M., Sutherland, D. Zhang, H., Zhou, L., Gregoire, J. M., Gomes, C. P., van Dover, R. B., Thompson, M.O. Enhancing Active Learning Framework for Material Discovery and Optimization Through Incorporation of Physical Insights and Multimodal Data. *Material Research Society Meeting Fall 2023, Boston, MA*
3. **Chang, M. C.**, Ament, S., Amsler, M., Sutherland, D., Gomes, C. P., van Dover, R. B., Thompson, M.O. Integrated autonomous and user-guided active learning for targeted material synthesis. *Active Learning Material Science (AL4MS) 2023, Helsinki, Finland (Best talk award)*
4. **Chang, M. C.**, Ament, S., Amsler, M., Sutherland, D., Gomes, C. P., van Dover, R. B., Thompson, M.O. Probabilistic Phase Labeling Framework for Closed-loop Autonomous Experiments. *11th International Workshop on Combinatorial Materials Science and Technology 2022, Denver, CO*
5. **Chang, M. C.**, Ament, S., Amsler, M., Sutherland, D., Gomes, C. P., van Dover, R. B., Thompson, M.O. A Real-Time, Physically Informed, Probabilistic Phase Labeling Algorithm for High-Throughput X-Ray Diffraction Studies. *Material Research Society Meeting Fall 2021, Boston, MA*
6. **Chang, M. C.**, Ament, S., Amsler, M., Sutherland, D. R., Sun, R. R., Gomes, C. P., van Dover, R. B., Thompson, M.O. A Phase Mapping Algorithm to Accelerate High Throughput Experiments. *Material Research Society Meeting Spring 2021 (Virtual)*
7. **Chang, M. C.**, Agne, M. T., Michi, R. A., Dunand, D. C., & Snyder, G. J. Compressive Creep Behavior of Hot-pressed TAGS-85. *The Minerals, Metals & Materials Society (TMS) Annual Meeting 2018, Phoenix* (Poster)



# Leadership Experience

- President, Cornell Taiwan Student Association, 2021-2022
- Vice President, Taiwanese Student Association at Northwestern University, 2017
- Social Chair, Department of Material Science and Engineering Student Association, National Taiwan University, 2014-2015