陳 靖 天 助理教授

Ching-Tien Chen, ASSISTANT PROFESSOR

- 國立臺灣大學 學士，民國一百零二年
- 國立臺灣大學 碩士，民國一百零四年
- 日本東京大學 博士，民國一百零九年

- B.S. National Taiwan University, 2013
- M.S. National Taiwan University, 2015
- Ph.D. The University of Tokyo, 2020

主要研究領域

沸石是工業中常見的功能性孔洞材料，為鋁矽酸鹽結晶及其相關無機結晶的總稱，至今已發現超過250種結構。沸石材料獨特的孔道形狀及活性位點，使其廣泛應用於吸附、分離、離子交換、及催化程序。本實驗室著重在理解沸石的形成機制、調控沸石的結晶過程、並合成功能性沸石材料以解決環境議題，包含：

- **塑膠廢棄物的轉化**

  透過設計沸石觸媒，將塑膠廢棄物選擇性轉化為高價值之化合物，以實現廢棄物增值及促進永續發展。我們將探討沸石性質對產物分佈之影響，並發展流動式反應器以達到連續處理廢棄物之目的。

- **環境汙染物的去除**

  全氟/多氟烷基物質(PFAS)為生活中常見的防水、抗油材料，廣泛用於廚具及紡織物等日常用品。如今，PFAS已累積在環境中，成為難以分解的有機致癌物。我們將調控沸石的吸附性質，選擇性去除水中的PFAS及其衍生物，以保護環境及生態。

- **沸石的形成機制**

  沸石的形成過程牽涉到鋁矽酸鹽在次奈米級別的結構變化，一直是此領域待解的議題。我們將使用臨場技術對沸石合成過程進行時間解析，以了解如何控制沸石結晶，提升合成效率。

Main Research Interests

Zeolites are functional porous materials commonly used in industry, which represents a group of crystalline aluminosilicates and related inorganic crystals with over 250 topologies discovered so far. These materials are widely applied in adsorption, separation, ion exchange, and catalytic processes owing to unique pore structures and active sites. We focus on understanding and controlling the crystallization of zeolites and synthesizing functional zeolites to address environmental challenges, including:

- **Conversion of Plastic Waste**

  By designing zeolite catalysts, we aim to selectively convert plastic waste into high-value compounds, achieving waste valorization and promoting sustainability. We investigate how zeolite properties affect product distribution and develop continuous-flow reactors for the efficient processing of plastic waste.

- **Removal of Environmental Pollutants**

  Per- and polyfluoroalkyl substances (PFAS) are commonly used as water- and oil-repellent materials in consumer products such as cookware and textiles. PFAS, however, have accumulated in the environment and become persistent organic pollutants that cause cancer. We tune the adsorption sites of zeolites for the selective removal of PFAS and their derivatives from water to protect our ecosystems.

- **Zeolite Formation Mechanism**

  Formation mechanism of zeolites represents a long-standing question in this field, involving structural transformations of aluminosilicates at the sub-nanometer scale. We employ in situ techniques to analyze the zeolite synthesis process in real-time, aiming to understand how to control zeolite crystallization and enhance synthesis efficiency.

代表作 (Selected Publications)

- **C.-T. Chen**, A. Sviripa, S. Verma, C. Paolucci*, D. W. Flaherty*, Reactions of Surface Peroxides Contribute to Rates and Selectivities for C_2H_4 Epoxidation on Silver. *ACS Catal.* **2025**, 15, 1387-1398.
- **C.-T. Chen**, K. Iyoki*, P. Hu, H. Yamada, K. Ohara, S. Sukenaga, M. Ando, H. Shibata, T. Okubo, T. Wakihara*, Reaction Kinetics Regulated Formation of Short-Range Order in an Amorphous Matrix during Zeolite Crystallization. *J. Am. Chem. Soc.* **2021**, 143, 10986-10997.
- **C.-T. Chen**, K. Iyoki*, Y. Yonezawa, T. Okubo, T. Wakihara*, Understanding the Nucleation and Crystal Growth of Zeolites: A Case Study on the Crystallization of ZSM-5 from a Hydrogel System Under Ultrasonication. *J. Phys. Chem. C* **2020**, 124, 11516-11524.