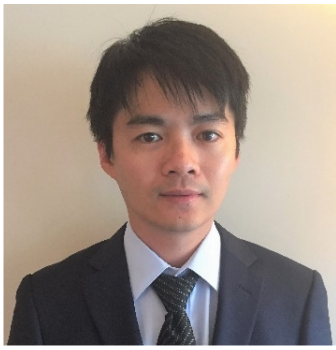
楊 東 翰 副教授

TUNG-HAN YANG, ASSOCIATE PROFESSOR



- 國立成功大學 學士，民國九十八年
- 國立清華大學 碩士，民國一百年
- 國立清華大學 博士，民國一百零六年

- B.S. National Cheng Kung University, 2009
- M.S. National Tsing Hua University, 2011
- Ph.D. National Tsing Hua University, 2017

主要研究領域

本實驗室致力於材料科學、化學反應動力學、奈米化學與科技、晶體合成與光譜分析、反應器設計及觸媒工程應用等領域。目前研究主題包括:

- **晶體材料合成、鑑定及生長機制**

  研究奈米晶體材料及合成過程所涉及的化學原理與生長技術。發展化學反應動力學，搭配光譜分析技術，定量解析晶體成核與成長機制。探索金屬、多金屬、高熵合金及半導體晶體的物理、化學及結構性質。

- **晶體材料綠能及觸媒應用**

  控制奈米晶體材料觸媒之尺寸、晶面、元素組成及空間分布 (固溶體、界金屬及相分離等)、結構 (單晶、多晶及孿晶等) 及原子堆積方式 (面心立方及六方最密等)，應用於二氧化碳還原生成化學燃料、氧氣還原及水分解產氫等催化反應。

- **化學反應器設計及晶體材料製程放大**

  設計批次及連續流動式化學反應器，放大量產奈米晶體材料，進而推動晶體材料實際應用於化學合成與汽車觸媒等工業。

Main Research Interests

Our group focus on materials science, chemical kinetics, nanochemistry and nanotechnology, nanocrystal characterization and spectral analysis, design of chemical reactor, and catalytic application. Current research includes the following three topics:

- **Synthesis, Characterization, and Mechanistic Understanding of Nanocrystal Materials.**

  We aim to bring revolutionary advances to the colloidal synthesis of monometallic, multimetallic, high-entropy alloy, and semiconductor nanocrystals with controlled physicochemical properties. We also focus on the mechanistic understanding and control of nucleation and growth of nanocrystals by developing new tools and methods capable of capturing, identifying, and quantifying the nuclei, seeds, and nanocrystals.

- **Nanocrystal Materials for Green Energy and Catalysis.**

  We develop the synthetic strategy to maximize the catalytic activity and selectivity of a nanocrystal catalyst by engineering its size, surface structure, composition (e.g., solid-solution metallic, intermetallic, phase-segregated), stacking phase (e.g., fcc, bcc, hcp), and crystal structure (e.g., single-crystal, singly-twinned, multiply-twinned, stacking-fault lined), for applications of CO2 reduction, O2 reduction, H2 generation, and so on.

- **Design of Chemical Reactors for Scalable Production of Nanocrystal Materials.**

  To build a bridge between academic research and industrial applications, our group design various batch and continuous flow reactors for the scale-up production of nanocrystal materials while keeping high quality and good uniformity.

代表作 (Selected Publications)

- T. H. Yang, J. Ahn, S. Shi, P. Wang, R. Gao, and D. Qin*. Noble-Metal Nanoframes and Their Catalytic Applications. Chem. Rev., In Press.
- T. H. Yang, Y. Shi, A. Janssen, and Y. Xia*. Surface Capping Agents and Their Roles in Shape-Controlled Synthesis of Colloidal Metal Nanocrystals. Angew. Chem. Int. Ed. 59, 2, 2020.
- T. H. Yang, K. C. Chiu, Y. W. Harn, H. Y. Chen, S. C. Lo, J. M. Wu, and Y. H. Lee*. Electron Field Emission of Geometrically-Modulated Monolayer Semiconductors. Adv. Funct. Mater. 28, 1706113, 2018.
- T. H. Yang, S. Zhou, K. D. Gilroy, L. Figueroa-Cosme, Y. H. Lee, J. M. Wu, and Y. Xia*. Autocatalytic Surface Reduction and Its Role in Controlling Seed-Mediated Growth of Colloidal Metal Nanocrystals. Proc. Natl. Acad. Sci. USA 114, 13619, 2017.
- T. H. Yang, H. C. Peng, S. Zhou, C. T. Lee, S. Bao, Y. H. Lee, J. M. Wu, and Y. Xia*. Toward a Quantitative Understanding of the Reduction Pathways of a Salt Precursor in the Synthesis of Metal Nanocrystals. Nano Lett.17, 334, 2017.