Dr. Daming Zheng

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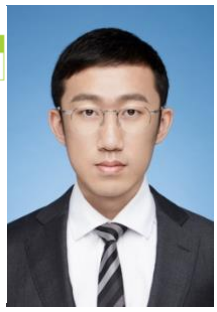

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Executive Summary

Highly motivated, results driven and multitasking researcher with more than three years of professional research experience in organic-inorganic optoelectronic material synthesis, characterization, and application. Quick learner, strong independent research capability, excellent interpersonal and communication skills.

Education Background

PhD	Major in **Physical Chemistry**
2018-2021	École nationale supérieure de chimie de Paris,
(Supported by China	***Université PSL (2022 World Ranking: 38),*** France.
Scholarship Council)	Supervisor: Prof. Thierry Pauporté

Master	Major in **Chemical Engineering**
2015-2018	College of Chemistry and Chemical Engineering
	Xiamen University, China.
	Supervisor: Prof. Song TU
Overall Score	83/100 (**Rank:** top 10%)

Bachelor	Major in **Chemical Engineering and Technology**
2010-2014	College of Chemistry and Chemical Engineering
	South-central University For Nationalities, China.
Overall Score	82/100 (**Rank:** top 10%)

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Work Experience

Postdoctoral	Institute of Microscale Optoelectronics
2022-now	***Shenzhen University,*** China.
	Cooperative Tutors: Prof. Michael Geoffrey Somekh

Visiting Researcher	École nationale supérieure de chimie de Paris
2022-now	***Université PSL,*** France.
	Cooperative Tutors: Prof. Thierry Pauporté

Visiting Researcher	Institut de NanoSciences de Paris
2022-now	***Sorbonne Université,*** France.
	Cooperative Tutors: Prof. Laurent Coolen

Research Interests

1. Effects of nanoparticles on the performances of perovskite solar cells (Combination of simulation and experiment).

One of my research topic is used spectroscopic ellipsometry to characterize state-of-the-art methylammonium lead iodide cells and develop a model for accurate description of the cell's optical properties. We then introduced gold nanoparticles into the cell's active layer in order to estimate potential plasmonic optical effects. Through the combination of theoretical simulation and experiment, we found that the presence of even a very low concentration of nanoparticles (too low to cause plasmonic enhancement of light absorption) could increase the photovoltaic efficiency significantly. After an extensive study of the gold- nanoparticle cells, using a very broad range of characterization techniques, we were able to show that the efficiency increase was due to an improved crystalline quality of the perovskite layer, caused by a modification of the crystallization kinetics [one or two papers will be written in the coming months]. It is on the basis of the above work that we discovered the infinite possibilities of nanoparticles in perovskite solar cell.

2.In-depth application of Glow-Discharge Optical Emission Spectroscopy (GD-OES) in perovskite related Photovoltaic Devices.

GD-OES is one of the few detection technologies that have not been widely used in the field of perovskite related Photovoltaic Devices and I am the first to fully develop the function of GD-OES using in perovskite solar cell. Therefore, this detection technology has great development space which can help us to detect film formation mechanism, track the cell ageing process and element distribution, especially facing complex composition of perovskite. Moreover, GD-OES can be also used to detect the cell with biased treated, which can help us to figure out the hysteresis caused by anion migration. By integrating and differentiating the results obtained, we can explore the corresponding mechanism in a deeper level. During my PhD, I have developed three main functions of using GD-OES in perovskite solar cell, but I firmly believe that through the use of GD-OES, there will be more functions to be explored and the same function can be also applied to other kinds of Photovoltaic Devices, like tandem photovoltaic or scalable fabrication of efficient perovskite solar modules.

Core Skills

Morphological characterization:

Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscopy (AFM).

Crystal characterization:

X-Ray Diffraction (XRD), X-ray photoelectron spectroscopy (XPS), Glow-discharge optical emission spectroscopy (GD-OES), Differential Scanning Calorimetry (DSC), Energy Dispersive Spectrometer (EDS), Thermogravimetric Analysis (TGA).

Optical characterization:

Ultraviolet and visible spectrophotometry (UV-Vis), Time-resolved Photoluminescence (TRPL), Steady-state Photoluminescence (PL)

Solar cells characterization:

Solar simulator (*J-V*), External Quantum Efficiency (*EQE*), Impedance Spectroscopy (IS), Tracking *PCE*, Electrochemical Work Station.

Chemical characterization:

Nuclear Magnetic Resonance (NMR), Gas Chromatography-Mass Spectrometry (GC-MS)

Preparation equipment:

Glove-box, Spin-coater, UV ozone cleaner, Hotplate, Electrode evaporation instrument, Tube Furnace, Muffle Furnace, etc.

Data processing:

Origin, Excel, etc.

Hobbies

Clarinet, Football, Travelling, Classical music, Calligraphy, etc.

Papers published in peer-reviewed journals

[1] ***Daming, ZHENG***; Tao, Z.; Yanfa, Y.; Pauporté, Th. Controlling the formation process of Methylammonium-Free Halide Perovskite films for a homogeneous incorporation of alkali metal cations beneficial to solar cell performances. *Adv. Energy Mater.*, **2022**, 2103618.

[2] ***Daming, ZHENG***; Catherine, S.; Yoann, P.; Zakarya, O.; Coolen, L.; Pauporté, Th. How Do Gold Nanoparticles Boost the Performance of Perovskite Solar Cells? *Nano Energy*, **2022**, *94*, 106934.

[3] ***Daming, ZHENG*** and Pauporté, Th. Control by Mixed-Chloride Additives of the Quality and Homogeneity of Bulk Halide Perovskite upon Film Formation Process. *J. Mat. Chem. A* **2021**, *9*, 17801-17811.

[4] ***Daming, ZHENG***; Tao, Z.; Pauporté, Th. A Co-additive Strategy for Blocking Ionic Mobility in Methylammonium-Free Perovskite Solar Cells and High-Stability Achievement. *Sol. RRL* **2021**, 2100010.

[5] ***Daming, ZHENG***; Tao, Z.; Pauporté, Th. From Mono- to Triple-Cation Hybrid Perovskites for High-Efficiency Solar Cells: Electrical Response, Impedance, and Stability. *ACS Appl. Energy Mater.* **2020**, *3*, 10349−10361.

[6] ***Daming, ZHENG***; Changheng, T.; Tao, Z.; Yaoguang, R.; Pauporté, Th. Effects of 5-Ammonium Valeric Acid Iodide as Additive on Methyl Ammonium Lead Iodide Perovskite Solar Cells. *Nanomaterials*, **2020**, *10*, 2512.

[7] ***Daming, ZHENG***; Tao, Z.; Raffin, F.; Volovitch, P.; Pauporté, Th. Control of Perovskite Film Crystallization and Growth Direction to Target Homogeneous Monolithic Structures for High Efficiency Solar Cells. **2021**. submit to *Materials Today*, Under Review.

[8] ***Daming, ZHENG***; Pauporté, Th. Application of Glow Discharge Optical Emission Spectroscopy in Perovskite Solar Cell. **2022**. submit to *Materials Horizontal*, Under Review.

[9] Tao, Z.; ***Daming, ZHENG***; Jiawen, L.; Coolen, L.; Pauporté, Th. PEAI-Based Interfacial Layer for High-Efficiency and Stable Solar Cells Based on a MACl-Mediated Grown $FA_{0.94}MA_{0.06}PbI_3$ Perovskite. *ACS Appl. Mater. Interfaces* **2020**, *12*, 37197−37207.

[10] Tao, Z.; ***Daming, ZHENG***; Rager, M.; Pauporté, Th. The Stabilization of Formamidinium Lead Tri-Iodide Perovskite through a Methylammonium-Based Additive for High-Efficiency Solar Cells. *Sol. RRL* **2020**, *4*, 2000348.

[11] Chenxi, M.; ***Daming, ZHENG***; Demaille, D.; Gallas, B.; Schwob, C.; Pauporté, Th. Coolen, L. Light management in highly-textured perovskite solar cells: From full-device ellipsometry characterization to optical modelling for quantum efficiency optimization. *Sol. Energ. Mat. and Sol. C.* **2021**, *230*, 111144.