



## **Department of Materials Science and Engineering Seminar Series 2026**

### **MOLTEN SALT CO<sub>2</sub> REDUCTION TO SOLID CARBON MATERIALS**

**FANG CHENG**

**Date and time: Tuesday, November 24, 2026, 4:00pm**

**Venue: EA-06-03**

#### **Abstract**

The conversion of CO<sub>2</sub> into stable, value-added carbon materials offers a promising approach to combining carbon utilization with advanced materials synthesis. Molten-salt CO<sub>2</sub> electroreduction can directly produce solid carbon nanomaterials, but its development has been limited by insufficient control over carbon morphology, limited understanding of carbon nucleation and growth, and predominantly batch-based operation.

This thesis investigates the controlled conversion of CO<sub>2</sub> into homogeneous carbon nanotubes (CNTs) and high-quality graphene. For CNT synthesis, the results support metallic Fe as the principal active catalyst, while an FeCO<sub>3</sub>-additive strategy enables the catalyst to be introduced independently of the cathode material. The evolution of Fe-containing species and the time-dependent growth of CNTs are further investigated to provide insights into CNT nucleation and structural development. For graphene synthesis, uniform and well-graphitized multilayer graphene is directly produced from CO<sub>2</sub> within several seconds. A systematic comparison of Cu and Ni substrates used for molten salt electrolysis reveals non-self-limited carbon growth on Cu and a dissolution–precipitation pathway on Ni, explaining their distinct carbon morphologies.

Building on these findings, a continuous roll-to-roll molten salt electrolysis system is developed for the production of both CNTs and graphene. Overall, this thesis advances the controlled synthesis of carbon nanomaterials from CO<sub>2</sub>, provides new insights into their nucleation and growth mechanisms, and establishes a basis for the further development and scale-up of continuous molten salt CO<sub>2</sub> electroreduction.

## **Biography**

Fang Cheng is currently a Ph.D. candidate in the Department of Materials Science and Engineering at the National University of Singapore under the supervision of Prof. Andrew B. Wong. His doctoral research focuses on molten salt electrochemistry for converting CO<sub>2</sub> into high-value carbon nanomaterials, including carbon nanotubes and graphene, with particular emphasis on electrochemical synthesis, carbon growth mechanisms, and continuous manufacturing.

**Please join us!**

HOST: Asst. Prof Zhao Ming