

Faculty of Engineering

Summer Research Program 2023-2024

Project Title: Hydrogen production with carbon waste converted to CNS in cementitious materials

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Objective

The aim of this project is to investigate the optimal conditions for converting carbon waste into carbon nanospheres (CNS) during hydrogen production through methane thermal cracking. The project will also study the dispersion behavior and the effects of CNS coating on various cementitious materials. By exploring the feasibility of utilizing carbon waste from hydrogen production in construction and infrastructure, this project can contribute to Australia's transition towards a circular economy.

Project Details

In this project, the conversion of carbon waste into carbon nanospheres (CNS) on construction materials during hydrogen production via methane thermal cracking will be investigated using an atmospheric pressure chemical vapor deposition (APCVD) setup. Students will have the opportunity to choose one of the following six tasks:

Task 1: Optimizing reaction parameters and substrate blends to enhance CNS nucleation and growth, leading to increased hydrogen yields and reduced production costs;

Task 2: Understanding the dispersion behavior of CNS grown on specifically designed blends, ensuring efficient utilization of their superior properties, such as high strength and conductivity, by studying their distribution in the matrix environment;

Task 3: Studying the effect of well-dispersed carbon nanospheres (CNS) on the microstructure of CNS-modified cementitious materials using AI-based characterization techniques;

Task 4: Investigating the effects of blends with carbon nanosphere (CNS) coating on the hydration, mechanical strength, and durability of ordinary Portland cement (OPC);

Task 5: Exploring the effects of blends with carbon nanosphere (CNS) coating on the geopolymer system;

Task 6: Assessing the potential application of carbon nanosphere (CNS)-reinforced concrete/geopolymer in full-scale structural elements.

Prerequisites

N/A