21st nanobiofluids seminar

2025 Dec 5th, 15:00-16:00
Conference Room (Room 134), 1st Floor, Bldg. No.1
https://www.infront.kyoto-u.ac.jp/en/access/
Zoom link

Carbonation kinetics in cementitious materials: lab-on-a-chip approach

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Abstract
This seminar investigates the mechanisms of carbonation in cementitious materials to address CO_2 sequestration challenges. Key objectives include: (1) advancing understanding of dissolution and precipitation via lab-on-a-chip (LoC) methods, and (2) evaluating amino acids for enhancing carbonate mineral nucleation, growth, and stability. Specifically, it focuses on tricalcium silicate dissolution using LoC technology and confocal laser scanning microscopy, revealing how surface reactivity, undersaturation, and hydrodynamics drive kinetics and ion release. Next, it examines precipitation in porous media via LoC device, using sodium sulfate crystallization. Results show pore structure, temperature, and humidity influencing crystal growth and polymorph stability, informing strategies for optimized carbonation. Finally, it explores glycine as an additive in carbonation curing of Portland cement. Glycine boosts calcium dissolution, CO_2 uptake, and polymorph control, improving mechanical strength and durability.

Biography
Professor Duan is a researcher in material science and engineering mechanics, holding a B.Eng. (1997) and M.Eng. (2002) from Tianjin University, China, and a Ph.D. (2006) from the National University of Singapore.

Professor Duan conducted interdisciplinary research on nanocomposites and nanomechanics at Monash University.

Prof. Duan founded the ARC Nanocomm Hub (2017–2024), fostering collaboration among 13 Australian universities, 7 international institutions, and 50 industry partners. In 2024, he established the ARC NetZero Hub to advance net-zero civil infrastructure using digital technologies and robotics. As an ARC Laureate Fellow (2025–), he focuses on low-carbon cement innovations and was elected a Fellow of the Australian Academy of Technological Sciences and Engineering (ATSE) in 2021.

Host: Hirofumi Shintaku, shintaku@infront.kyoto-u.ac.jp