

Special Lecture

Date and Time: Tuesday, September 29, 2026, 10:00–11:00

Venue: Meeting Room, 2nd Floor, Building 1, Institute of Fluid Science, Tohoku University,
and Online (Hybrid: Google Meet)
<https://meet.google.com/xnc-vhkr-qjr>

Lecturer:

James S. Cotton

Professor, McMaster University, Canada

Lecture Title:

Electrohydrodynamic heat transfer in phase change materials - Collaboration with Institute of Fluid Science

Abstract:

Electrohydrodynamics (EHD) offers a powerful means of enhancing and actively controlling solid-liquid phase-change heat transfer. Applied electric fields generate electroconvection that thins thermal boundary layers, accelerates melting, and can induce solid extraction, in which dendritic material is drawn from the mushy zone into the liquid phase. Experiments have demonstrated local heat-transfer enhancement approaching 8.6-fold and reductions in total melting time of nearly 40%. Schlieren velocimetry has revealed coherent EHD jets and provides a non-intrusive means of quantifying the resulting flow and thermal-boundary-layer transport. Particular attention is given to the distinction between conventional charge injection and field-enhanced dissociation. Charge injection relies on ions generated at electrode surfaces, whereas low-frequency alternating-current dissociation produces reversible ionic motion within the dielectric fluid, potentially reducing electrode-driven chemical degradation while generating directed transport toward the melt interface. These mechanisms create new opportunities for electrically tunable, high-performance phase-change thermal energy storage.

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