10 November 2025 SSM 104

MATERIALS AND BIOMATERIALS SCIENCE AND ENGINEERING

Ice: a resource and adversary, but really 'just' a material

ABSTRACT: Ice is found nearly everywhere, in the cryosphere and at altitude here on earth, and throughout the solar system. Across these environments, ice is rarely found as a homogenous medium, but instead as a mixture of water, dissolved salts, entrapped particles and volatiles, molecular constituents, and/or biological matter. These heterogeneous factors influence ice formation and dynamics –from freezing point depression (colligative and non-colligative), microstructural fabric and stability, metamorphism, crystallization mechanism, crystal shape and habit, as well as material properties and performance, including thermal conductivity, melt rate, albedo and reflectance, strength, creep, and failure mode. Broadly, the field of ice science and engineering encompasses the fields of chemistry, biology, geology, physics, as well as civil, mechanical, and materials engineering, making the study of ice a multi-disciplinary undertaking.

Ice is often perceived by humans as a cold material that causes major inconveniences in the environment; however, ice is also a resource material for infrastructure in Polar regions. Building from a fundamental understanding of ice as a material, this presentation will discuss the state-of-the-art in ice materials science, namely the manipulation and exploitation of ice properties at interfaces and in bulk form, to address applications in aviation, building, and cryopreservation.

BIOGRAPHY: Dr. Emily Asenath-Smith is a senior research materials engineer at the US Army Engineer Research and Development Center (ERDC) Cold Regions Research and Engineering Laboratory (CRREL) in Hanover, NH, where she leads both the Ice Adhesion Facility and the Advanced Materials Team. She completed her formal academic studies in the fields of chemistry, ceramic engineering, and materials science and engineering and has leveraged her training to build a thriving research team who is focused on the materials science of ice and crystalline materials. Dr. Asenath-Smith's research portfolio and team are currently focused on three broad areas related to ice: ice modulation, ice interfaces, and structural ice. Applications include ice mitigation, ice friction, ice inhibition & promotion, as well as high performance ice as a building material. Sponsoring agencies include the US Army, DARPA, NASA, and ONR as well as an assortment of small businesses and corporations. Across all these efforts, Dr. Asenath-Smith and The Advanced Materials Team strive to solve complex challenges and provide novel solutions to US military needs in cold and complex environments.

Emily Asenath-Smith

US Army Cold Regions Research and Engineering Laboratory

Refreshments: 1:45pm, **Seminar**: 2-3pm