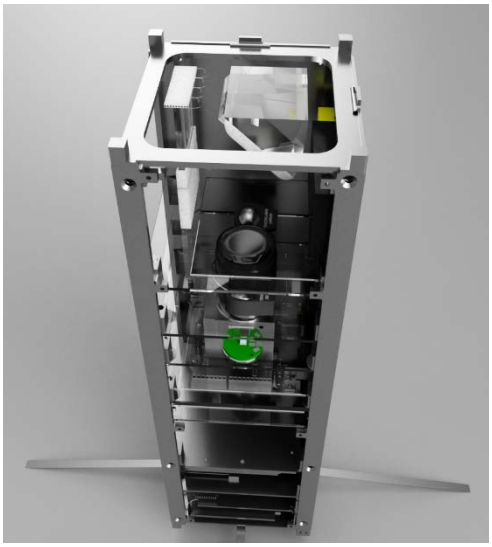
Project Title: SpaceICE

Advisors: Dr. Alexander Ghosh

Project Description:



Freeze-casting is a novel materials fabrication technique that utilizes ice as a fugitive space-holder to create highly complex, three-dimensional pore structures and net-shape objects. In this process, an aqueous suspension of particles is placed onto a cold plate. Ice nucleates at the cold surface and a planar ice front starts propagating. Due to the presence of inert particles, a constitutional undercooling region develops causing breakdown of planar ice and formation of dendrites. Under proper conditions, dendrites grow directionally with the thermal gradient, while pushing suspended particles away from the moving front. Rejected particles form an accumulation layer ahead of the solidification front and are forced to assemble within interdendritic space as solidification progresses. After solidification, ice is removed and the resulting, anisotropic structure is sintered to densify pore walls

This technology will be demonstrated in space on a CubeSat platform. The University of Illinois will be constructing the satellite, while Northwestern University will be constructing the freeze casting payload.

Student Background and expected research activities:

The student should have a strong interest in space hardware development, and previous experience working with and designing spacecraft hardware is desired. The student will work in an interdisciplinary team, and assist with the design of a spacecraft bus. A diverse range of skillsets are sought, and being any of the following would put a student in consideration: programmer, electrical engineer, mechanical or aerospace engineer. The student may assist with the design and update to a system appropriate for their skillset such as the structure, the power system, the payload interface, the communication system and the command and data handling system.

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Funding: USIP Program. Two positions will be funded to work on SpaceICE.