UCMERCED UNIVERSITY OF CALIFORNIA Graduate MECHANICAL ENGINEERING

Fall 2021 Graduate Seminar

Buoyancy Effects on Material Flammability

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Faculty of Engineering and Sciences
Universidad Adolfo Ibáñez

Friday, September 3rd, 2021; 2:00-3:00 pm; Location: Zoom

Zoom link: https://ucmerced.zoom.us/j/82516784524

Meeting ID: 825 1678 4524

Abstract

Understanding material flammability inside a spacecraft is important because the conditions in spacecraft environments can greatly differ from those on earth. Because in a gravity field there is a flame-induced buoyancy, it is very difficult to reproduce on Earth the environmental conditions of a spacecraft, or a habitat in the Moon or Mars, thus making fire testing and burning predictions harder. To overcome this problem, alternative approaches that reduce buoyancy are required. The objective of this work is to explore the possibility of simulating the effect of gravity, and in turn buoyancy, through changes in ambient pressure, on upward/concurrent flame spread over a combustible solid, and by comparisons with available data at different gravity levels, observe up to what point low-pressure can be used to replicate flame spread characteristics at different gravities. Specifically, this work consists of experimental research done to study the flame spread behavior of solids in normal gravity and low pressure and in microgravity and normal pressure. Results show that reductions of pressure slow down the flame spread over the fuel surface. Comparison with the microgravity data show that as the pressure is reduced, the normal gravity flame spread rate approaches that in microgravity. The data presented is correlated in terms of a mixed convection non-dimensional number that describes the convective heat transferred from the flame to the solid, and that also describes the primary mechanism controlling the spread of the flame. The correlation provides information about the similitudes of the flame spread process in different environments, providing guidance for potential ground-based testing for fire safety design in spacecrafts.

Biography

Dr. Maria Thomsen is an assistant professor at the Faculty of Engineering and Sciences at the Universidad Adolfo Ibáñez in Santiago, Chile. Dr. Thomsen received her Ph.D. degree in Mechanical Engineering from the University of California Berkeley in Berkeley, California in 2018. She was part of the Combustion and Fire Processes Laboratory (CFP) in UCB where she held a postdoctoral position until 2020. Her research interests include material flammability and fire spread under different environments, with a special focus on spacecraft applications. She currently studies fire and burning behavior of solid fuels in future spacecraft conditions through experimental and numerical modeling research.

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