COMBUSTION WEBINAR

From hotspot flame initiation to Li-ion battery thermal runaway

Speaker: Prof. Peng Zhao, Oakland University

Time: *Nov. 7, 2020*
10 am EST; 4 pm Paris; 11 pm Beijing.

Meeting: *Zoom*

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Biography: Dr. Peng Zhao is an assistant professor of Mechanical Engineering at Oakland University. He obtained his PhD from the Department of Mechanical and Aerospace Engineering at Princeton University in 2015. His research interests primarily focus on fundamental-based and application-oriented problems in the frontier areas of combustion, propulsion, fuels and safety. His current research activities include open source multi-physics modeling, low-volume high-throughput fuel ignition screening, advanced engine combustion strategy, Li-ion battery safety and thermal runaway, etc. He has published nearly 40 journal articles and 1 book chapter, with a google H-index of 15. He was awarded the Bernard Lewis Fellowship by the Combustion Institute in 2018 and he is a member of the Early Career and Diversity Development Committee of the US Section of the Combustion Institute. In Spring 2021, he will join the University of Tennessee, Knoxville as an associate professor in the Space Institute and the Department of Mechanical, Aerospace and Biomedical Engineering.

Abstract: Hotspot induced flame initiation and subsequent propagation is one of the most important phenomenon in both fundamental and practical combustion. In this talk, recent developments are reported on hotspot flame initiation under elevated temperatures, followed by extension of related combustion concepts to the study of Li-ion thermal runaway. First of all, results have shown that when ignition energy is below the minimum ignition energy (MIE) of regular hot flames, a class of cool flames could be directly initiated, which exhibits intrinsic similarity in propagation regimes but completely different response to stretch, compared to a regular hot flame. Furthermore, simulations have been performed to explain the recently observed negative temperature dependence of iso-octane flame speed measured in a shock tube. It is found that for relatively low ignition energy in the intermediate temperature range, a novel over-driven flame regime featured by substantial fuel thermal pyrolysis can be triggered and consequently lead to non-monotonicity in the observed flame speed. Last but not least, combustion concepts such as MIE is naturally extended to investigate the safety regime of Li-ion battery thermal runaway.