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Editorial: Improved Understanding of Firebrand Processes During Large Scale Fire Disasters

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Editorial on the Research Topic

Improved Understanding of Firebrand Processes During Large Scale Fire Disasters

All across the globe, large outdoor fires have been responsible for destruction of infrastructure. Wildland fires that spread into urban areas, often called wildland-urban interface (WUI) fires, are capable of massive destruction. The rise of densely populated urban areas has also seen the development of large urban fires. In China and Japan, such urban fires have occurred for hundreds of years. Similarly, the United States has also experienced several major urban fires, such as the Great Chicago Fire in 1872 and the Baltimore Fire in 1904. In some cases, earthquakes have served to initiate these fires but it is not a necessary condition for these urban fires to develop. In addition, the rise of informal settlement communities in Southeast Asia and Africa continues to result in large outdoor fires capable of great destruction.

A common feature in the rapid spread of large outdoor fires are the generation of smaller combustible fragments from the original fire source, referred to as firebrands. In the case of WUI fires, the production of firebrands occurs from the combustion dynamics of vegetative, such as trees and shrubs, and human-made fuel elements, such as homes and other structures. For urban fires and informal settlement fires, firebrands are produced primarily from human-made fuel elements.

Firebrand combustion has a series of important aspects: initial generation or formation from the combustion of both vegetative and structural fuel types, transport, deposition, and ignition of fuel sources generally far removed the original fire source. Post-fire investigations, for WUI fires, have reported that firebrand processes are responsible for a majority of structure losses in these fires (https://link.springer.com/referenceworkentry/10.1007/978-3-319-51727-8_46-1).

As part of this Research Topic in *Frontiers in Mechanical Engineering*, nine papers were ultimately accepted for publication. Several studies in this Research Topic are focused on firebrand generation characteristics from burning vegetation. In the studies by Adusumilli et al. and Almeida et al., experiments were undertaken to better understand firebrand generation characteristics at the individual tree and shrub level. Noteworthy is the use of advanced diagnostics, such as particle image velocimetry (PIV), to investigate these generation processes (Almeida et al.). In the work of Thomas et al., field experiments were undertaken to attempt to couple the fire dynamics to the firebrand processes.

Two of the contributed papers investigated the complex process of firebrand deposition. Mankame and Shotorban conducted numerical simulations around simplified flow obstacles and Suzuki and Manzello conducted real-scale experiments, in an effort to shed light on the physics of firebrand deposition. Firebrand deposition processes within communities remain an area that has been largely unexplored.

Lastly, four of the contributed papers all focused on the processes of ignition by firebrands. Salehizadeh et al., attempt to determine critical conditions for wood ignition by simulated firebrand piles using small-scale experiments. Wang et al., considered fundamental experiments of wood discs to better understand combustion processes need to understand firebrand ignition. In the work of Bean and Blunck, ignition of both solid and porous surfaces was considered. Bearinger et al., tried to look at various parameters to determine what are the key sensitivities to ignition from firebrands.

AUTHOR CONTRIBUTIONS

SM was invited to develop and lead this Research Topic by Frontiers in Mechanical Engineering. He invited and assembled the team of guest editors. SS, NL, and DV each served as editor for various papers in the Research Topic.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.