Numerical modeling of thermal ignition

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Abstract
The study of thermal ignition is key to predict, prevent, mitigate and assess the risk of accidental fires and explosions. Careful experiments of canonical/simple geometries have been performed over the years at Caltech to gain fundamental understanding of the phenomenon. Parametric studies analyzing the effect of size of the hot surface, mixture concentration, geometry and ignition time scales on ignition thresholds have been carried out. However, detailed numerical simulations of the experiments to study the dynamics of ignition and the most important physical and chemical processes that control ignition had not been performed. Can we reproduce the experimental ignition thresholds and reaction regimes? When/where does ignition take place? What are the key processes taking place at the ignition location? Numerical simulations of the three geometries studied experimentally (i.e. moving heated spheres, rapidly and slowly heated surfaces) were performed to answer these questions.

Short Biography
Currently a Postdoctoral Scholar in Aerospace at the California Institute of Technology (Caltech), Josué Melguizo-Gavilanes received his Ph.D in Mechanical Engineering from the University of Calgary in Canada in 2012. Before coming to Caltech in January 2014, he worked as a researcher for Royal Dutch Shell in Calgary. His research experience is primarily in Computational Fluid Dynamics (CFD) and analytical modeling of reacting flows. Specifically, understanding ignition due to shock induced and thermal processes using simplified and detailed chemistry. The main motivation of his work is industrial and aircraft safety. Other research interest include alternative sources of energy and physiological fluid dynamics.