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Effect of straining flow and droplet shape on vaporization rate of liquid fuel droplet MEHA SETIYA, JOHN A PALMORE JR., Virginia Tech — This study focuses on the effect of planar straining flow on the vaporization of droplets. This work is motivated by spray combustion in gas turbines where the turbulence inside the combustor leads to the presence of both significant flow strain and droplet deformation. While a small amount of literature exists on the effect of droplet deformation on vaporization, there are no systematic investigations of the effect of flow strain on the vaporization of freely-deforming droplets. Recent theoretical studies on ellipsoidal droplets suggest that deformation enhances the vaporization rate. Additionally, our initial studies [Eastern States of the Combustion Institute, 2020] suggest that flow strain can also impact the vaporization rate. Therefore, a complete understanding of droplet vaporization requires studying the interaction between both droplet deformation and flow strain. This study uses an in-house code for interface-resolved direct numerical simulations of vaporizing multiphase flows. It mimics a freely-deforming droplet falling at its terminal velocity with an imposed strain rate. The influence of the deformation and flow strain on vaporization will be investigated by varying the relevant non-dimensional groups such as the Weber number and the non-dimensional strain rate.

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