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MOVING BOUNDARY PROBLEM FOR HEATING AND EVAPORATION OF A SPHERICAL DROP

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ABSTRACT The process of heat and mass transfer from a spherical liquid drop evaporating into a gas environment is investigated relaxing the commonly used quasi-steady approximation and accounting for the inherent unsteadiness caused by the sudden immersion of a liquid drop in a gaseous environment. The drop radius shrinking due to evaporation settles a moving boundary problem, which is changed to a fixed boundary one by a proper coordinates transformation. The heat and evaporation rates and the drop diameter evolution is quantified by numerical solution of the species and energy conservation equations and the overall mass and energy balances over the drop for different species (water, n-octane, n-dodecane, ethanol). The paper extends the analysis previously reported by the same authors by considering the coupling between the species and energy equations.