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Formation of vortex rings and drops at particle-laden fronts in thermally stratified environments CHEN-YEN HUNG, YI-JU CHOU, National Taiwan University — We conduct numerical simulations to investigate the formation of drops and vortex rings at particle-laden fronts descending in density stratified environments. We show that the temporal evolution can be divided into double diffusion, acceleration, and deceleration phases. The acceleration phase is a result of the vanishing temperature perturbation in the drop during the descent in the layer of uniform temperature. The drop decelerates because it transforms into a vortex ring, whose motion follows the similarity assumption. A theoretical drag model is presented to predict the spherical drop speed with the low drop Reynolds number. In conjunction with the similarity argument for the motion of the vortex ring, our drag model shows good agreement in predicting the drag coefficient for the drop after the drop becomes spherical. Comparison of our drag model with simulations under various bulk conditions and previous experimental results shows good model predictability for the descending speed of drops.

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