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The effect of residence time on the dynamics of a condensating aerosol in a Hiemenz-type stagnation flow AMJAD ALSHAARAWI, KUN ZHOU, GIANFRANCO SCRIBANO, ANTONIO ATTILI, FABRIZIO BISETTI, King Abdullah University of Science and Technology, CLEAN COMBUSTION RESEARCH CENTER TEAM — The effect of residence time on the formation and growth of a condensating aerosol is simulated in a Hiemenz-type stagnation flow setup, for which a unique and well-defined time scale characterizes the velocity field. In this configuration, a hot stream saturated with dibutyle phthalate (DBP) vapor mixes with a cold dry stream. A mixing layer forms at the stagnation plane triggering supersaturation and droplets are generated by homogeneous nucleation. Aerosol dynamics are simulated using the Quadrature Method of Moments (QMOM). Two regimes related to the flow residence time are observed, i.e., a nucleation regime and a condensation regime. The nucleation regime, at short residence times, is characterized by the consumption of DBP vapor into droplets having a negligible effect on the vapor phase. In this regime, both the number density and volume fraction of droplets increase with residence time. In the condensation regime, at long residence times, vapor condensation consumes the vapor phase considerably. For longer residence times, more vapor is consumed, resulting in lower number densities due to the lower nucleation rates, whereas the volume fraction saturates.

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