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Role of two-phase air-mucus interaction on aerosolized drug delivery in idealized lung models RAHUL RAJENDRAN, ARINDAM BANERJEE, Lehigh University — Aerosolized drug delivery to the lung airways depends on the particle size, breathing pattern, and the airway geometry. The influence of the two-phase flow morphology and the local airflow structures developed in the mucus-lined airways of obstructive airway diseases, on the deposition of inhaled drugs is investigated. The Lagrangian particle tracking model is coupled with the multiphase Eulerian-Eulerian model to investigate the gas-liquid-solid flow in 3D idealized airway geometries. Mucus is modeled as a non-Newtonian fluid using the power-law equation, and flow turbulence is modeling using the low-Re k-ω SST model, including the eddy interaction model (EIM) for the particles. The results from the study are validated with experimental results from the literature and comparisons with constricted dry-wall airways are presented. The role of mucus rheology, airflow rate, particle size, airway geometry and gravity are discussed. A quantitative assessment on the global and regional deposition fractions of the particles, sites of deposition, clearance rates, pressure drop across the airway, and airway resistance in mucus-lined airways will be presented.

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