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Experimental investigation of particle deposition mechanisms in the lung acinus using microfluidic models. RAMI FISHLER, MOLLY MULLIGAN, YAEL DUBOWSKI, JOSUE SZNITMAN, Technion- Israel Institute of Technology, SZNITMAN LAB- DEPARTMENT OF BIOMEDICAL ENGINEERING TEAM, DUBOWSKI LAB- FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING TEAM — In order to experimentally investigate particle deposition mechanisms in the deep alveolated regions of the lungs, we have developed a novel microfluidic device mimicking breathing acinar flow conditions directly at the physiological scale. The model features an anatomically-inspired acinar geometry with five dichotomously branching airway generations lined with periodically expanding and contracting alveoli. Deposition patterns of airborne polystyrene microspheres (spanning 0.1 μm to 2 μm in diameter) inside the airway tree network compare well with CFD simulations and reveal the roles of gravity and Brownian motion on particle deposition sites. Furthermore, measured trajectories of incense particles (0.1-1 μm) inside the breathing device show a critical role for Brownian diffusion in determining the fate of inhaled sub-micron particles by enabling particles to cross from the acinar ducts into alveolar cavities, especially during the short time lag between inhalation and exhalation phases.

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