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Numerical analysis of the formation process of aerosols in the alveoli KARSTEN HASLBECK, JÖRG R. SEUME, INSTITUTE OF TURBOMACHINERY AND FLUID DYNAMICS TEAM — For a successful diagnosis of lung diseases through an analysis of non-volatile molecules in the exhaled breath, an exact understanding of the aerosol formation process is required. This process is modeled using Computational Fluid Dynamics (CFD). The model shows the interaction of the boundary surface between the streamed airway and the local epithelial liquid layer. A 2-D volume mesh of an alveolus is generated by taking into account the connection of the alveoli with the sacculi alveolares (SA). The Volume of Fluid (VOF) Method is used to model the interface between the gas and the liquid film. The non-Newtonian flow is modeled by the implementation of the Ostwald de Waele model. Surface tension is a function of the surfactant concentration. The VOF-Method allows the distribution of the concentration of the epithelial liquid layer at the surface to be traced in a transient manner. The simulations show the rupturing of the liquid film through the drop formation. Aerosol particles are ejected into the SA and do not collide with the walls. The quantity, the geometrical size as well as the velocity distributions of the generated aerosols are determined. The data presented in the paper provide the boundary conditions for future CFD analysis of the aerosol transport through the airways up to exhalation.

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