

Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Characteristics of airflow and particle deposition in COPD current smokers¹ CHUNRUI ZOU, JIWOONG CHOI, BABAK HAGHIGHI, SANGHUN CHOI, ERIC A. HOFFMAN, CHING-LONG LIN, Univ of Iowa — A recent imaging-based cluster analysis of computed tomography (CT) lung images in a chronic obstructive pulmonary disease (COPD) cohort identified four clusters, viz. disease sub-populations. Cluster 1 had relatively normal airway structures; Cluster 2 had wall thickening; Cluster 3 exhibited decreased wall thickness and luminal narrowing; Cluster 4 had a significant decrease of luminal diameter and a significant reduction of lung deformation, thus having relatively low pulmonary functions. To better understand the characteristics of airflow and particle deposition in these clusters, we performed computational fluid and particle dynamics analyses on representative cluster patients and healthy controls using CT-based airway models and subject-specific 3D-1D coupled boundary conditions. The results show that particle deposition in central airways of cluster 4 patients was noticeably increased especially with increasing particle size despite reduced vital capacity as compared to other clusters and healthy controls. This may be attributable in part to significant airway constriction in cluster 4. This study demonstrates the potential application of cluster-guided CFD analysis in disease populations.

¹NIH grants U01HL114494 and S10-RR022421, and FDA grant U01FD005837

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Date submitted: 02 Aug 2017

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