Dust-loading of pleated surface filters – simulation and validation

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ABSTRACT: To increase filtration surface area per volume, air filter media are often pleated. In surface filtration, a dust cake grows on top of the media until the pleats clog. The properties of the dust and dust cake are crucial for filter lifetime and determine, along with desired volume flow, optimum pleat geometry. However, the spatial distribution of the dust in the pleat is hard to predict, especially if inertia of the dust particles cannot be neglected. We developed a method to simulate incremental dust build-up in the pleat using commercial CFD software. In addition to overall pressure drop, spatial dust distribution is an important parameter for the validation of the method. X-ray tomographic images allow access to the spatial dust distribution without the need to destroy the filter sample. This way, the dust distribution can be measured at several loading steps on the same sample and it is possible to compare simulation results to loading experiments.