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# Filter media design for Dust Holding Capacity by computer simulations

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The goal of this study is to optimize a dual-fiber filter media by increasing the dust holding capacity (DHC), while maintaining the initial pressure drop and initial filter efficiency. Three main parameters define the performance of a filter, namely the DHC, filter efficiency and pressure drop. The DHC defines the quantity of solid particles which a filter media can trap and hold before the maximum allowable pressure drop is reached. The key idea is the use of micro structure models to optimize the filter media. To generate various filter media, the FiberGeo module of GeoDict® software is used, while the FlowDict and FilterDict modules simulate the flow behavior and the particle filtration behavior of the media, respectively.
Three different dual-fiber filter media are modelled. They all consist of the same two types of glass fibers (bi-modal diameter distribution). The distribution of the coarser fibers is uniform for all three models. They provide stiffness to the media and support the finer fibers. However, the finer fibers are distributed differently over the through-direction of the filter media [1]. The three models are called homogeneous model, linear increasing model, and exponentially increasing model. The naming scheme is based on the distribution of the finer fibers in through-direction of the filter media. In order to make the three models comparable, they were designed to have the same pressure drop in the clean state and to have the same initial filter efficiency. To ensure this, FlowDict and FilterDict simulations were used to guide the choice of geometric model parameters. The first simulation step is to model the filter media with different spatial distributions of the two types of fibers. The next step is to simulate the clean fluid flow through the filter media. The final step is to simulate the particulate flow and particle deposition.
Filtration simulations on the three different models were done using the FilterDict module of GeoDict®. Filter life time simulations were carried out using the multi pass mode. In a multi pass simulation, fluids move in a circuit through the system, and the particle size distribution and concentration in front of the filter change over time. Outputs of these simulations are pressure drop, filtration efficiency and count/mass of the deposited dust as a function of time. The results show that by changing the distribution of the thin fiber type over the through-direction, the DHC of the filter media changes as well. In this way, the structure of the dual-fiber filter media can be optimized to achieve higher DHC, while keeping the initial pressure drop and initial filter efficiency the same.

## References

[1] M. Silin, S. Jaganathan, Optimal gradient hydraulic media to maximize dust holding capacity, Proceedings of FILTECH 2015, 24.-26. Feb. 2015, Cologne, Germany.

[2] GeoDict, the Digital Material Laboratory, www.geodict.com.

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