A MODEL PROCESS TO DEVELOP FIRST-RATE FILTRATION SOLUTIONS

USING EXTENSIVE EXPERTISE AND THE LATEST SIMULATION SOFTWARE, GKD IS HELPING OPTIMIZE FILTRATION ACROSS A WIDE RANGE OF INDUSTRIES AND APPLICATIONS

Throughout the world, industries rely on critical applications that have many effects on our daily lives. Filtration in a wastewater treatment plant or crude oil filtration represent day-to-day processes that simply cannot fail.

As filtration processes become even more technical and nuanced, the need for more precise, innovated mesh filtration solutions is critical.

To ensure these systems meet the highest retention rates before implementation, GKD has developed a solution to help engineers optimize their filtration across diverse market sectors, including water, automotive, food and beverage and oil and gas. Using their knowledge of porous structures along with state-of-the-art simulation tools, GKD is able to help their customers quickly and effectively create custom filtration solutions.

THE MODELING PROCESS

The process is multi-faceted, ensuring the highest quality mesh for filtration. To begin the process, GKD meets extensively with each customer to understand their filtration challenges and the product standards that must be met. From there, GKD gets to work developing new filter meshes focusing on porous structure and permeability.

The modeling is aided by GeoDict® software, developed specifically for porous structures. The software is utilized for multi-scale 3D image processing, modeling of materials, visualization, material property characterization and optimization for simulation-based materials. The process also uses OpenFOAM, a software tool used specifically by universities and research institutions.

Through simulation testing, GKD has recognized multiple mesh materials suitable for microfiltration needs.

Specifically, Optimized Dutch (ODW6) weaves with selectivity from 6-to-100 μm use a single-layer mesh design to separate particles under six μm in large-scale water processing. This also predestines ODW6 weaves for filtration of outlet water at sewage plants, preventing microplastics from entering urban waters.

This performance can be attributed to weave with slot-shaped pores on the mesh surface, and larger pores inside the mesh. The structure allows for particles of the requisite separation limit to pass through the mesh without any issues. Therefore, the surface filter combines filtration rates down to the microfiltration range with high permeability and dirt holding capacity.

A low clogging tendency and good backwash ability guarantee a long service life for ODW6 weaves. This is also underlined by mechanical strength and high pore stability thanks to more stainless steel wires across the surface area than in conventional fabrics.

POROMETRIC MESH AND ADDITIONAL DESIGNS

In addition to Optimized Dutch weaves, Porometric mesh offers a stable filtration solution. Porometrich mesh features a three-dimensional weave with selectivity from 20-to-170 μm, which results in a significant ratio of pore opening to permeability. Despite an open design. Porometric combines a high separation rate with stability in-use.

Porometric mesh is also offered in a stainless steel or purely synthetic design. Compared with standard synthetic meshes available in the market with 20 μm or 25 μm apertures, Porometric mesh made of synthetic wires delivers almost five times the flow rate. The use of plastic also allows both cost and weight reductions.

The GKD portfolio now also includes a hybrid version of Porometic up to 20 μm. This version combines the respective advantages of plastic and metal in a single weave and is ideal for applications where the use of plastic would make cleaning more difficult due to static charges. Additionally, a new saltwater-proof Porometric design with 24 μm pore opening was designed to deliver significant savings potential for downstream UV treatment operations.

Custom combinations of various materials and special weave types in a single design allow GKD to develop previously unknown solution approaches for a large number of industrial applications. The individually developed spectrum of mesh design characteristics opens up a wide range of optimization potential through use of up to ten material components in a single mesh. This includes alternative drive applications, such as batteries or fuel cells.

With new mesh development and advanced software, the simulation features key aspects to model advanced, high-quality filtration solutions.

REAL MODEL GENERATION

For microfiltration, precision is key. And precision hinges on creating the most realistic simulation for filtration challenges. To depict realistic filtration situations, GKD virtually creates single-layer, multi-layer or pleated filtration mesh. That mesh can then be combined with nonwoven, foam or other filter media.

Integrating existing filtration mesh in the simulation environment by means of computerized tomography (CT) scan is also possible. This procedure helps precisely analyze the pore geometry of the filter medium before the actual calculation.

CALCULATION OPTIONS

The simulation model ranges from simple calculations of pressure loss to analyzing entire filter systems. GKD is able to accurately predict the largest pores or the pore size distribution and porosity of a filtration mesh or mesh bundle. Complex calculations can be realized including, observation of multiphase flows, fluid structure interactions (FSI) and heat transmission on woven structures.

Once the intricate aspects of filtration are correctly analyzed, the simulation process moves to development.

FROM THEORY TO PRACTICE

Results determined through simulation then allow development engineers to optimize flow control in accordance with the operational scenario. Particular focuses in practice include, flow optimization of filter packages, reduction of pressure loss and identification of filter surface efficiency.

Once application parameters are met, technical weaves are designed with the highest expectations of industrial users fully vetted.

MODEL PERFORMANCE

The efficient development of critical filtration systems is due to high-performance simulation environments. With elements such as fast feasibility checks and in-house prototype construction better solutions are being created quickly and to the highest standards.

When simulation is coupled with fully automated, state-of-the-art manufacturing, the technical weaves meet even the highest expectations of industrial users in terms of quality, process reliability and cost-effectiveness.