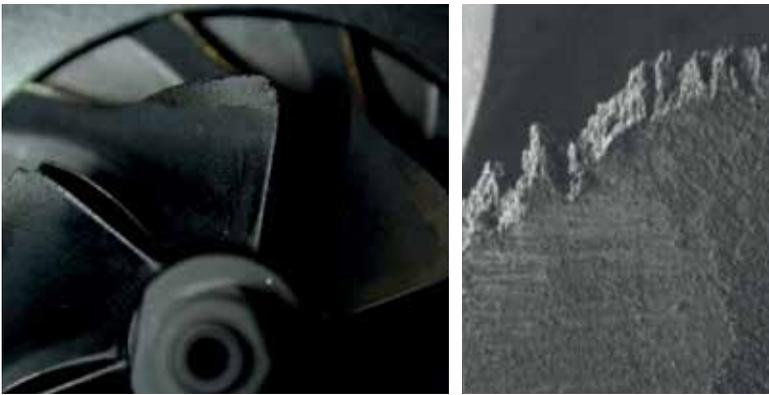


VOLUMETRIC MESH AND FILTER FOR THE AUTOMOTIVE INDUSTRY

LP EGR FILTER + PARTICULATE OXYDATION CATALYST (POC)



FILTER FOR EXHAUST GAS RECIRCULATION (EGR)



Damaged compressor wheel – no emergency filter used

Vehicle manufacturers and suppliers are working in close partnership to develop new solutions for reducing fuel consumption and thereby also CO₂ emissions. Low pressure exhaust gas recirculation (LP EGR) systems are one example of how they are attempting to increase the efficiency of diesel engines. These systems operate on the clean air side downstream of the particle filter with an emergency filter to protect the engine and turbocharger from soot and abrasive particles which might damage the compressor wheel.

REQUIREMENTS AND DESIGN QUESTIONS FOR LOW PRESSURE EGR (LP EGR) FILTER

> Basically and essentially requirements for a LP EGR Filter:

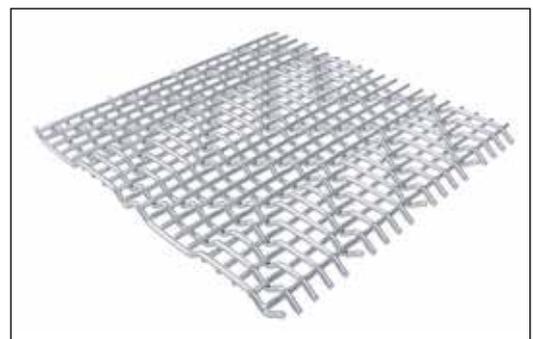
Filtering/ deposition of all particulates:	> 200 μm
Max. temperature:	300-850° C
Max. filter pressure loss:	3-20 mbar
Component cleanliness:	500 μm (hard particles)

Important for the selection of the LP EGR filter is the filter media and the design of the filter. The design and installation situations are usually determined by available space and specific requirements.

> Established on the market are two types of filters:

Radial filters: The component is installed in the main exhaust stream behind the DPF. The recirculated exhaust gas is filtered through a lateral outlet and fed to the cooler.

Cone filters: Located in the EGR line. The exhaust gas flows through the modified truncated cone filter in a longitudinal direction. The filter can be installed either directly behind the junction or directly in front of the cooler.



Volumetric mesh developed by GKD



EGR filter design using metal crimping developed by GKD

EMERGENCY FILTER FOR LOW PRESSURE EGR

When developing an EGR, a critical task is to avoid particles from the combustion cycle or the diesel particulate filter reentering the turbo charger or the engine. Woven wire meshes have some advantages compared to other filter media. E.g. they offer low pressure drop at defined pore sizes, depending on the construction of the mesh. Also they possess very narrow filtration efficiency.

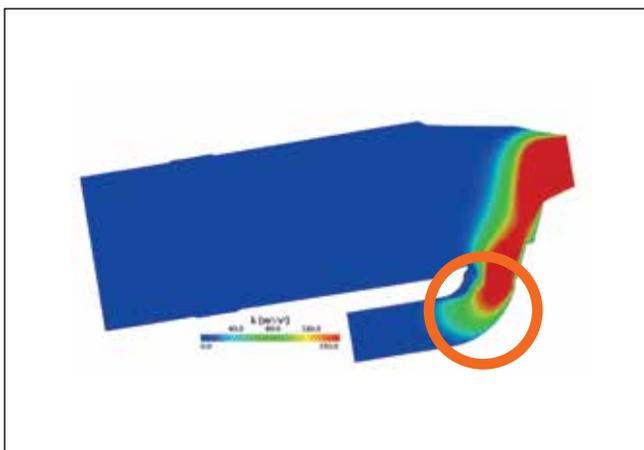
Our research focuses on single and multi-layered meshes as a control filter, also known as emergency filter, to prevent any particle from passing back into the engine and its components. Multi-layer meshes offer the same stability and durability as single layer-meshes, but can offer even better filtration efficiency and/or smaller pore sizes with low pressure drop. Especially GKD's new designed so-called Volumetric meshes have been qualified for LP EGR systems.

But the type of mesh is not the only important issue when dealing with low pressure EGR. The design of the filter element is as important as the mesh itself.

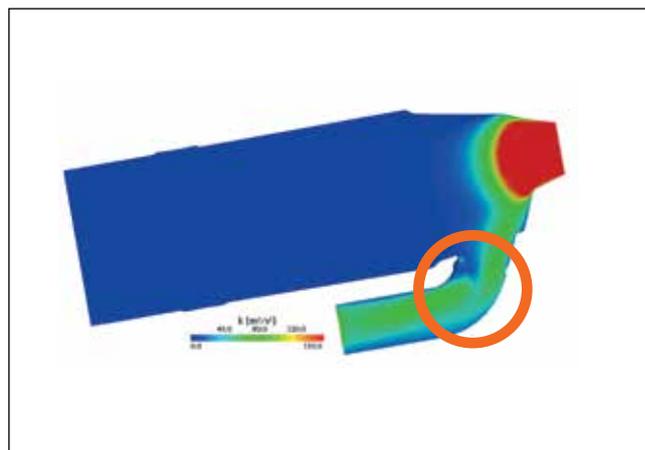
Shown below on the left is an EGR construction using a filter bag design. The position of the filter element is highlighted by the circle. The colors represent the kinetic energy of the turbulences developing in the flow. Turbulences on the other hand remove energy from the flow which will cause higher pressure drop or slower flow. Reducing turbulences is one way to increase the efficiency of the EGR. Together with an industrial partner, GKD develops various filter media and new designs for filter elements.

Shown below on the right is the result of one of the optimizations we managed to develop. Again the position of the filter is highlighted.

Research and development in our company is based on CFD simulation and laboratory tests to the limit of our technical capabilities. Large scale tests are usually done by our industrial partner. Supported by CFD tools, we design customer-specific woven wire meshes and various filter designs especially for EGR application to identify the optimum filter solution.



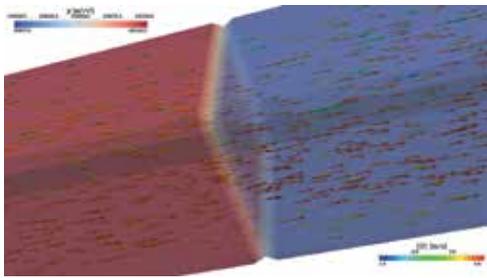
CFD analysis showing the kinetic turbulence inside an EGR filter



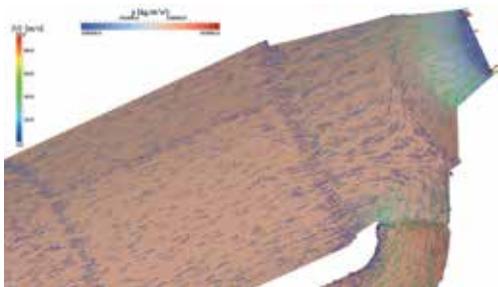
CFD analysis showing the kinetic turbulence inside an **optimized** EGR filter

EFFICIENCY OF THE FILTER DESIGNS:

FILTER PAD

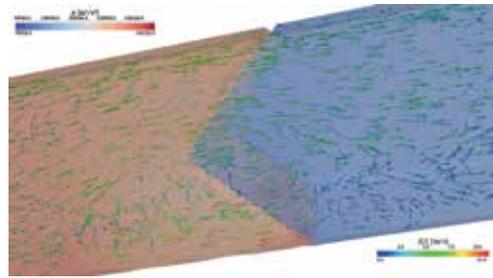


CFD simulation of a *flat porous filter*

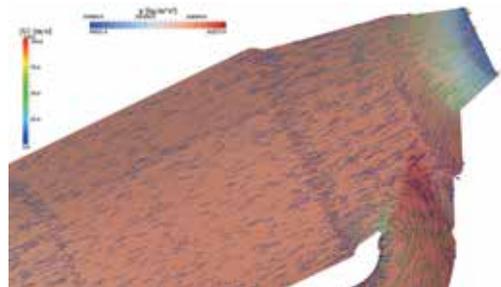


CFD simulation of an EGR system using a *filter pad*

FILTER POCKET



CFD simulation of a *pointed porous filter*



CFD simulation of an EGR system using a *filter pocket*

WIRE MESH FOR PARTICULATE OXIDATION CATALYST (POC)

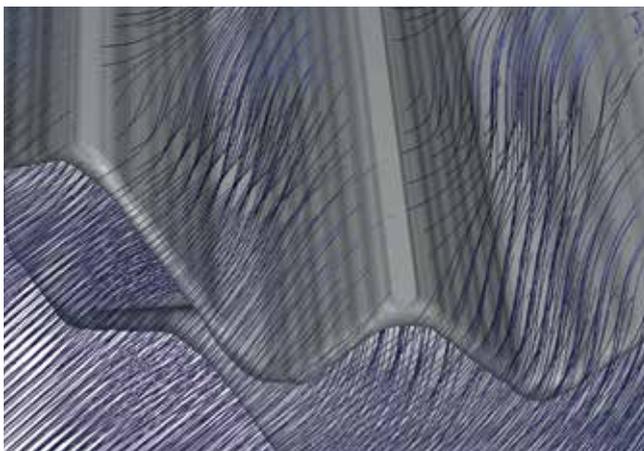
GKD has developed new metal wire meshes for the Diesel Particulate Oxidation Catalyst (POC). The POC is an open filter structure, developed to trap Particulate Matter in LD and HD diesel vehicles. The POC with screens out of wire mesh can increase the turbulent flow of the unit. The 3D design is produced with several corrugated wire mesh screen layers. The gas flows through the tortuous paths and uses the wire mesh to enable the gas to flow through the walls into the neighboring cells. A complete 3D flow is possible inside the substrate. The gas has the possibility to flow either through the straight channels or through the POC walls. Compared to conventional filter designs, the flow through a POC based on woven screens is very turbulent which improves the filtration efficiency.



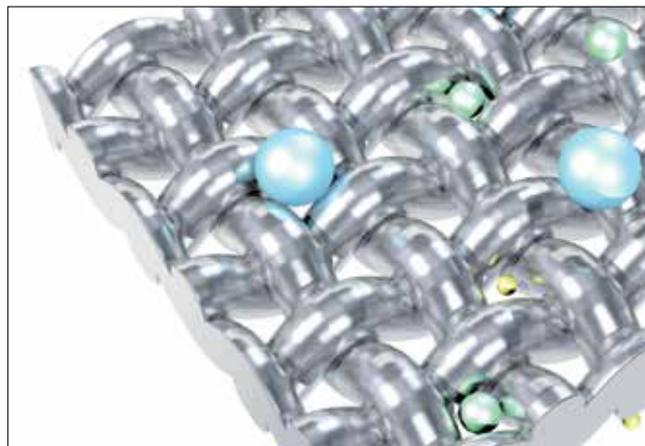
Pleated and corrugated woven wire mesh for POC

THE BENEFITS OF METAL WIRE MESH FOR POC:

- _ DEFINED PORE SIZES
- _ SIZE BENEFIT
- _ FLEXIBILITY IN SHAPE
- _ LOW WEIGHT
- _ EXTREMELY LOW PRESSURE DROP
- _ HIGH-TEMPERATURE MATERIALS
- _ IMMEDIATE CATALYTIC PERFORMANCE
- _ COATABLE
- _ HIGH RESISTANCE AGAINST THERMAL AND MECHANICAL SHOCKS



CFD calculation of a POC section



Wire mesh for POC

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GKD PROFILE

Weaving metal and other materials is the basis of our success. Since 1925, we have been continually re-interpreting the concepts of innovation and customer proximity. This passion for technology and exceptional solutions helped us to become one of the world’s leading technical weaving mills within the fields of industry and architecture. With superior manufacturing technology and comprehensive process expertise, we constantly tap new fields of application. GKD meshes are used to develop efficient systems, complete installations along with individual components that are integrated into the processes for our customers in all sectors and industries. Our **SOLIDWEAVE** division regularly sets new standards in the development and manufacture of high-precision metallic meshes and complex technical filter systems. Countless innovations carry our name in the form of universal standard products as well as custom designs.

SOLIDWEAVE MANUFACTURING EXPERTISE

With pioneering weave technologies, developed in-house, we process both ultrafine wires and innovative material combinations. We make use of the very latest simulation technology in order to be able to optimally design the functionality of our mesh to suit the relevant process. Our comprehensive range of equipment, as well as our sophisticated machining and finishing processes guarantee the long-term reliability of our products, while also facilitating seamless integration into industrial production processes. These include thermal processes, automated strip cutting, winding and joining techniques, coating, calendering, cleaning, as well as manufacturing under cleanroom conditions. Extensive inspection processes and strict, company-wide end-to-end quality systems allow for consistent product characteristics and comprehensible procedures. Customer satisfaction is always our benchmark.

GKD IS COMMITTED TO PROVIDING PRODUCTS AND SERVICE WHEREVER IT IS NEEDED. WORLD-WIDE.

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