

# Ceramic Injection Moulding (CIM) Process from QSIL Actively Contributes to Global CO<sub>2</sub> Reduction

Milestone for materials specialist QSIL: 11 million ceramic sliding shoes for axial piston pumps have been delivered. This ceramic component replaces DLC-coated steel parts as global standard for the 4-cylinder Diesel engines.



Fig. 1  
Ceramic sliding shoes

QSIL Ingenieurkeramik GmbH, based in Frankenblick/DE recently celebrated a milestone. There, they were pleased about the 11 millionth ceramic sliding shoe for axial piston pumps that left the factory. A proud number, because even if the pump component itself is only about the size of a fingernail, the more than 10 million vehicles that have been equipped with it so far would reach more than once around the earth if they were lined up along the equator.

It sounds a bit like a super jam, but technically it is a super thing that helps the

#### Keywords

ceramic sliding shoe, 4-cylinder Diesel engines, silicon nitride, ceramic injection moulding

manufacturers of diesel engines to reduce the emission of climate-damaging exhaust gases.

The sliding shoe developed by QSIL, which has quickly established itself as a standard component for controllable water pumps in 4-cylinder Diesel engines worldwide, runs against a stainless steel swash plate during engine operation. The pressure thus generated serves as a hydraulic actuator for controlling the control technology. This enables the engine's warm-up phase to be significantly shortened and, in the course of thermal management, the coolant flow can be regulated as required.

Shortening the warm-up phase contributes significantly to the reduction of climate-damaging exhaust gases during cold starts. In normal operation, the water pump can

be regulated according to demand. This reduces the power consumption of the pump and thus CO<sub>2</sub> emissions. The special feature of QSIL's sliding shoe is the material from which it is made: silicon nitride (Si<sub>3</sub>N<sub>4</sub>) ceramic, also known as non-oxide ceramic. Compared to conventional DLC-coated steel parts (DLC = Diamond-Like Carbon), this high-performance ceramic material offers better performance at a lower price. The decisive advantage of ceramic sliding shoes compared to sliding shoes made of coated steel is the significantly improved – i.e. lower friction. This reduces CO<sub>2</sub> emissions from vehicles and also increases driving comfort due to the shorter warm-up phase.

Better performance also means that the use of ceramics achieves high wear resistance, a homogeneous structure, low weight and high dimensional stability. The material does not cause any problems with layer build-up and is insensitive to all known media. In combination with these properties, this enables a stable, lean production process. The specific requirements of the automotive industry are a demanding challenge for any supplier. QSIL was faced with the task of ensuring the production of high volumes in a stable and traceable manufacturing process with strict quality mechanisms, which had to be both flexible and cost-effective.

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Since 2013, the company has been working with customers from the automotive industry to develop an injection moulding process for the component ceramic sliding shoe with the aim of mapping the required tolerances after sintering (= heating and solidifying the starting material) in a process-safe manner and suitable for large-scale production. The developed process proved to be particularly positive with regard to the freedom of shape design and contour accuracy.

The fact that the non-oxide ceramic material used in the so-called green state (i.e. before sintering) is very robust in further processing due to the binder also proved to be advantageous.

After an extensive and successful test phase, series production of the component finally started in 2016. With full utilisation of the machines, QSIL can produce up to

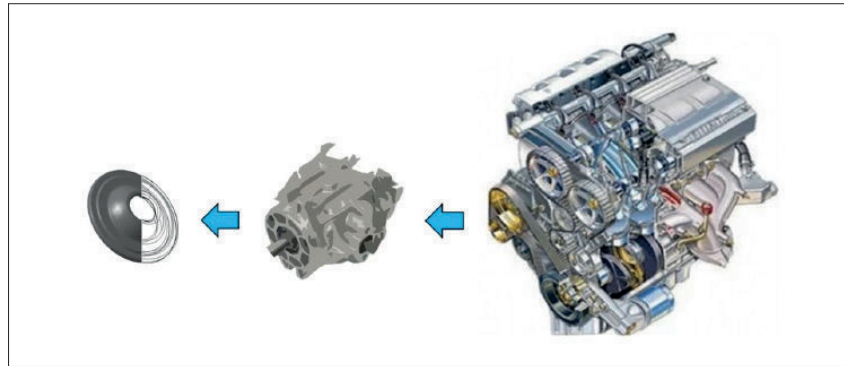


Fig. 2  
Ceramic sliding shoe for axial piston pumps in 4-cylinder Diesel engines

2,5 million ceramic sliding shoes per year in Frankenblick. The company was able to use the experience gained in the production of sliding shoes for many other series start-ups in injection moulding, which sig-

nificantly reduced the process development times. The injection-moulded parts from Frankenblick are now used not only in the automotive industry, but in all important key technologies.



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