



**High-Performance Friction Material Technology
for Automotive and Industrial Applications**

SCHAEFFLER GROUP

Together We Move the World

The Schaeffler Group is a world-renowned supplier of precision components for engines, [transmissions](#), and chassis applications for the automotive industry, as well as a leading manufacturer of rolling bearings and linear products.

As a reliable engineering partner, we satisfy our customers by delivering an unmatched combination of creativity and remarkable innovative ability, convenient locations and immediate accessibility throughout the world, highest levels of quality in all of our processes, as well as the ability to quickly respond to individual needs.

With its INA, FAG, and LuK brands, the Schaeffler Group is active in the automotive, industrial, and aerospace sectors. Approximately 66,000 employees at 180 locations (FY 2007) around the world are dedicated to serving our customers wherever they may be located.

As a family-owned company, the Schaeffler Group is focused on responsible management principles, consistent company growth, and actively shaping the corporate culture. Whether we are interacting with customers or with others within the company, our guiding principles are extraordinary commitment and focus, as well as mutual trust and dependability. In doing so, our work is defined by a passion to continuously improve our products and processes. We are proud to be judged on the merits of these values.



Friction Material Know-How from Specialists for Automotive and Industrial Applications: Schaeffler Friction Products

The name Schaeffler Friction Products represents many years of experience in development, production, and sales of friction materials. Schaeffler Friction Products became a subsidiary of the International Schaeffler Group from its clutch facing activities of the LuK Group and the independent friction material manufacturer Raybestos. These associations allow them to meet the highest demands in the sectors automotive and industrial friction products.

With Schaeffler Friction Products (Suzhou) Co., Ltd. in Chinese Suzhou the company has a high-performance production site in Asia which delivers friction materials to customers in the region meeting strict German quality standards.

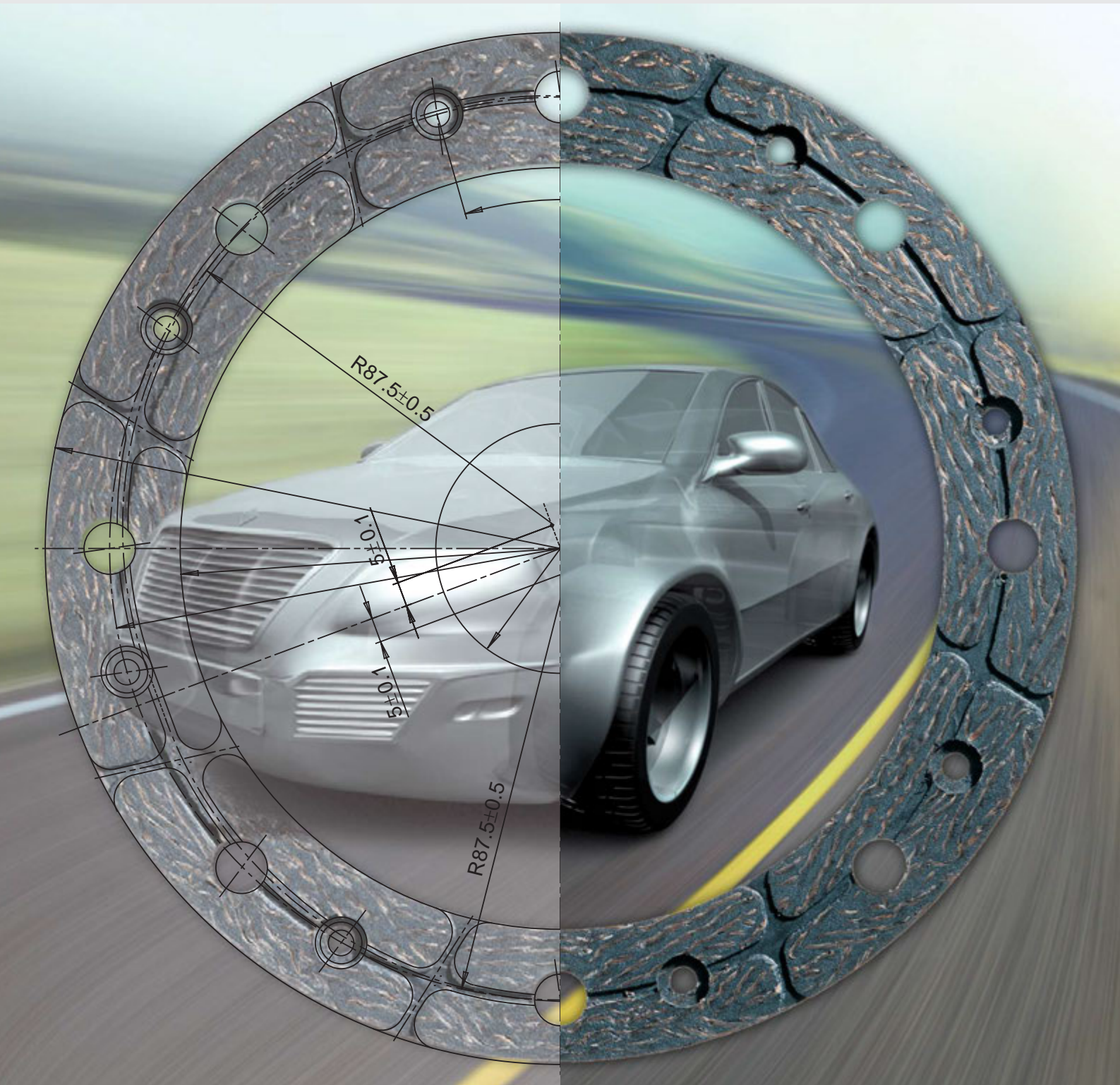
Currently the majority of products is used in the automobile industry, but Schaeffler Friction Products is expanding the friction material business also to industrial applications. Capacity of production sites in Morbach and Suzhou will be expanded through production plants in Hamm/Germany as LuK Friction GmbH and in Port Elizabeth/South Africa as Schaeffler South Africa (Pty.), Ltd. ensuring continuous customer supply.

Schaeffler Friction stands for competence, lasting product innovation, and global development partnership and is thus a reliable partner for customers all over the world.



Schaeffler Friction Products GmbH in Morbach/Germany
Schaeffler Friction Products (Suzhou) Co., Ltd. in Suzhou/China
LuK Friction GmbH in Hamm/Germany
Schaeffler South Africa (Pty.), Ltd. in Port Elisabeth/South Africa





Friction Material Know-How for the Automotive Industry

Schaeffler Friction Products offers clutch facings and friction washers for vibration dampers for automotive applications.

Demands on modern high-performance clutch facings have continued to increase in recent years. Certain automated transmission solutions, such as fuel-saving and dynamic double clutch transmissions, have only recently become possible due to the availability of high-performance clutch facing materials which are able to withstand high slipping demands and offering high fatigue strength.

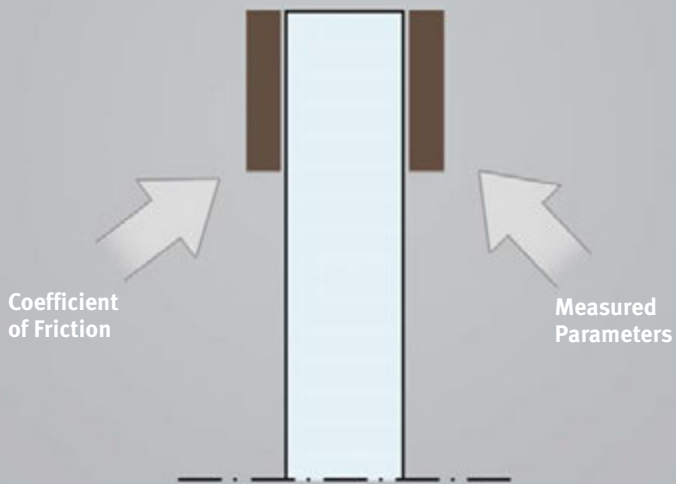
Schaeffler Friction Products supply about 78 % of all clutch facings for passenger car applications, while approximately 22 % are manufactured for heavy duty applications and tractors.

Schaeffler Friction Products has the most powerful clutch facing material on the market for commercial vehicle applications. Its high wear resistance has resulted in more than twice the service life of facings from recent years, offering an increase in efficiency and high operational reliability for our customers.



The clutch facings of Schaeffler Friction Products are synonymous for performance. The new DSG gearbox from Volkswagen is also fitted with the company's clutch facings.

PART OF FACING



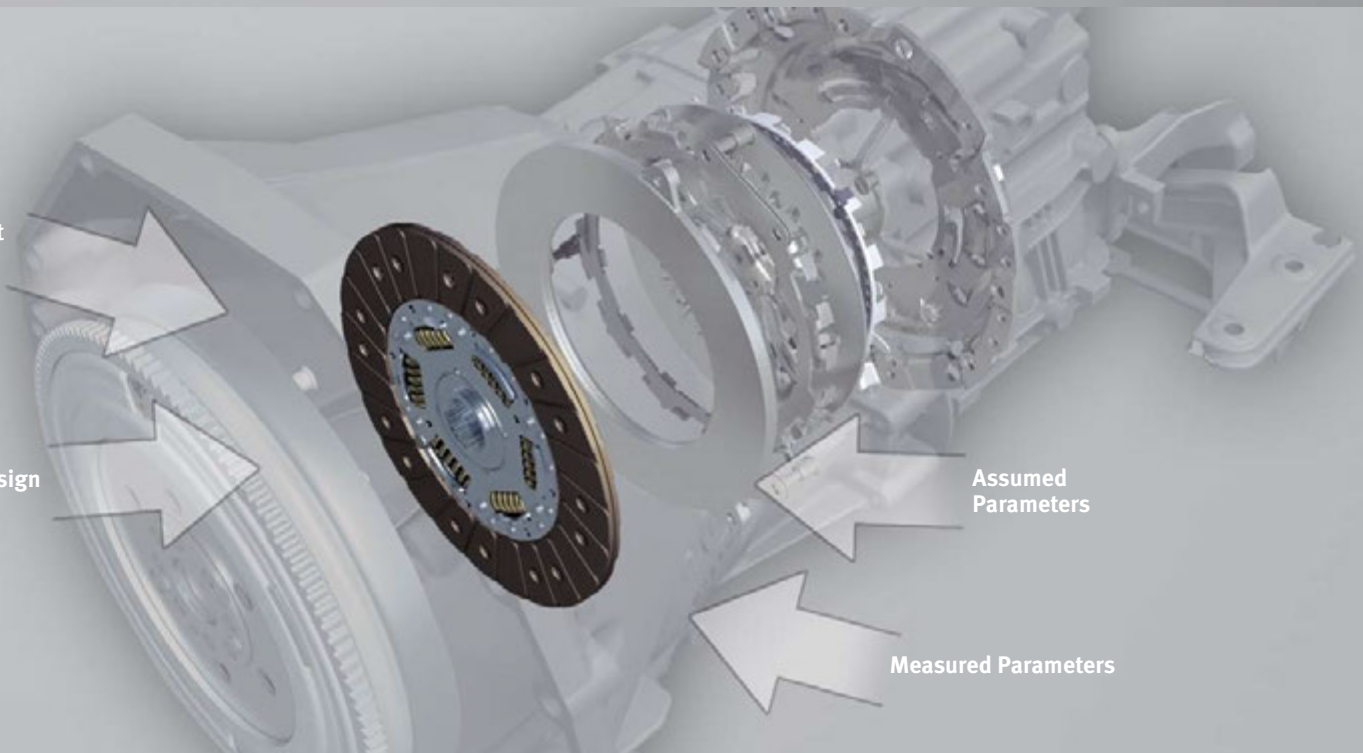
MODUL

Coefficient of Friction

Design

Assumed Parameters

Measured Parameters



VEHICLE

Environmental Conditions

Packaging

Coefficient of Friction

Engine

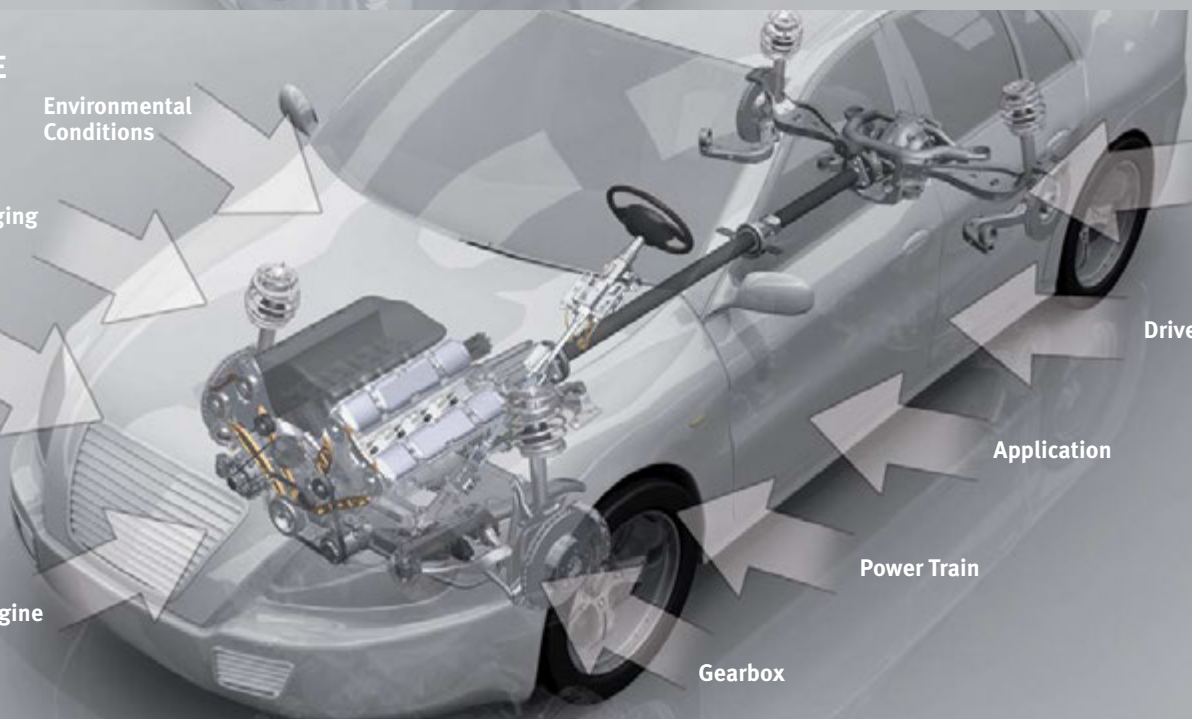
Gearbox

Power Train

Application

Driver

Design



From the Vehicle to the Clutch Facing and back: Tools for Product Development

Many vehicle manufacturers use clutch facings for series applications developed by Schaeffler Friction Products in close collaboration with OEMs and clutch manufacturers.

A consistent and structured product development process is the basis for our success. As part of this process, the know-how about the composition of different chemical basic materials by our experienced development team is combined with the comprehensive knowledge of our production specialists. As a result we are able to offer market-optimised friction materials manufactured economically, which are almost customised for various vehicle applications.

In order to fulfil the demanding market requirements we have established a three-phase developing process for our products:

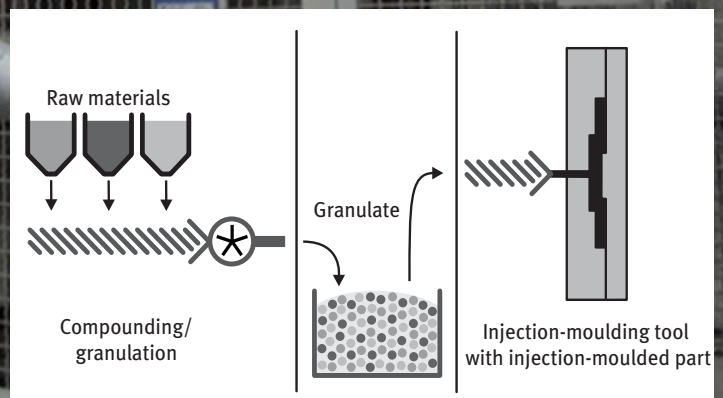
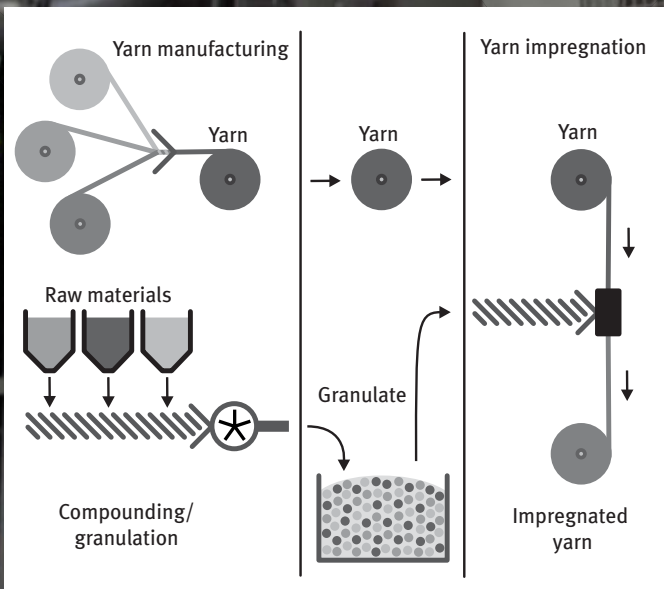
Depending on the demands of the overall vehicle, the individual parameters relevant to the system are isolated and examined through tests on small test benches. Here, new friction materials are strictly evaluated using standardised testing procedures. Only after showing favourable results, we continue to analyse the material on full clutch dynamometers. If all requirements are met in this phase, the new materials get finally verified in vehicles.

There, focus is on relevant functional tests as well as on long-term testing in our own vehicle fleets, with an emphasis on wear and comfort. Our strategy's main target is to characterise the properties of the friction material under the important conditions, without any negative influence from non-relevant system parameters. The advantageous side effect is both saving time and increasing confidence through the greater number of tests performed, from which our customers benefit.

Economic Production as Competitive Advantage

The development of friction material for series production in itself is not enough to ensure continuous success in the market. Effective material development must be completed by suitable process technology in order to secure successful company growth.

Schaeffler Friction Products masters all important production processes for high-performance friction materials for automotive and industrial applications.



Schematic illustration of production of LMF:
Solvent-free yarn impregnation protects resources.

Schematic illustration of injection moulding:
Future-orientated technology which allows a wide range of geometries.

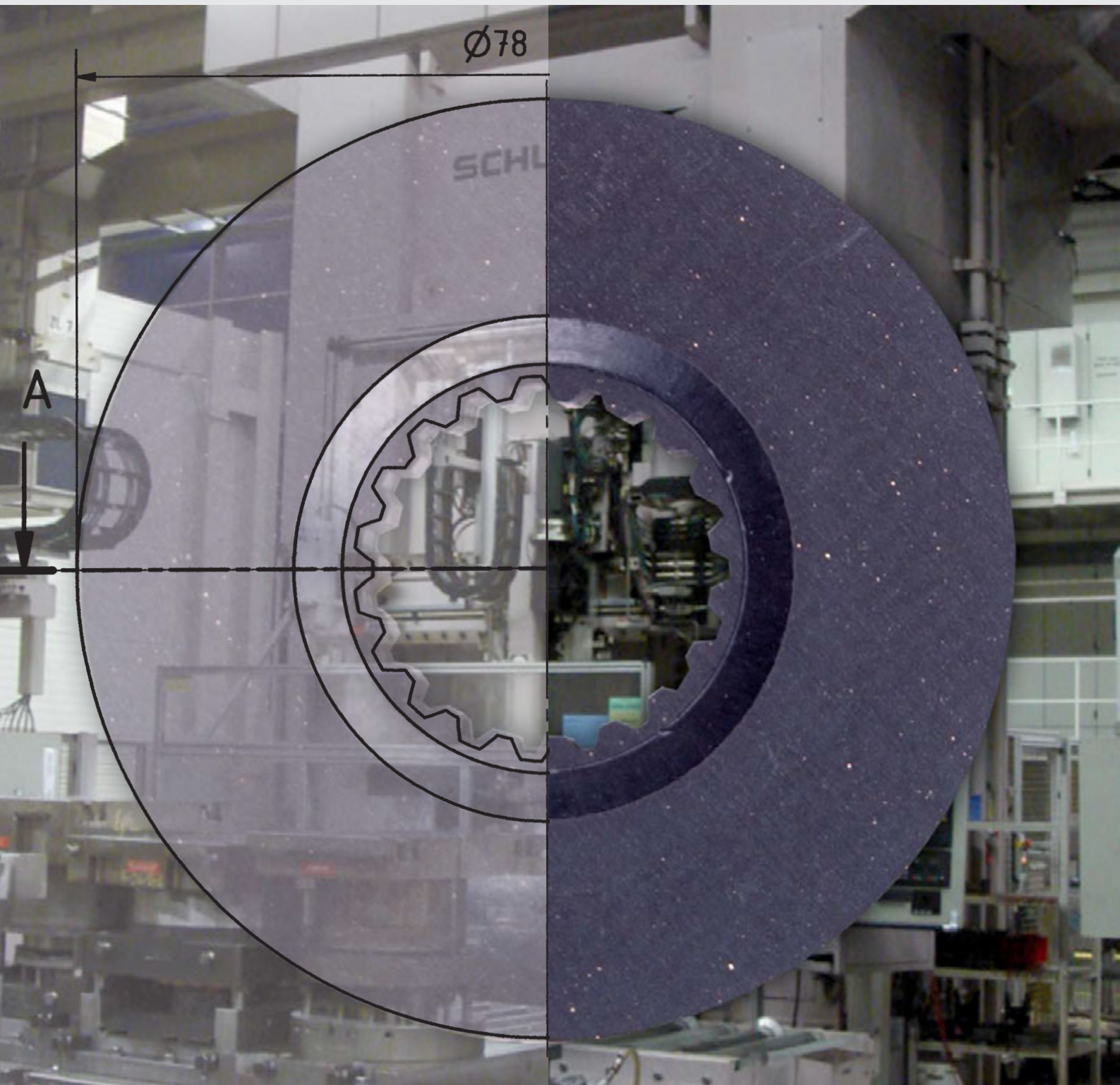
Based on the technical requirements we identify, together with our customers, the relevant friction material parameters and subsequently select the most suitable production method. The result are economically-manufactured friction materials with optimised properties.

Wound parts are manufactured by Schaeffler Friction Products either using the conventional yarn impregnation method with solvents or via the latest technology “LMF“, i.e. solvent-free yarn impregnation. This future-orientated production method emits 80 % less CO₂ than the conventional process with solvents due to its significantly reduced energy consumption.

A wide range of raw materials can be utilised by adopting the method of **moulded** friction material production. This process permits parts to be manufactured with a diameter of a few millimetres up to half a meter and allows the implementation of for material strength optimized components such as steel cores.

Rolling, a manufacturing process which can be used for friction washers, is characterised by high economic efficiency at good friction material performance.

The **injection-moulding technology** shows new ways to develop and manufacture friction materials. It combines superior tribological and mechanical characteristics with complex geometrical forms, such as undercuts and small wall thicknesses. A combination of these properties is not possible with conventional production methods. Therefore injection-moulding is a universal process with enormous potential.



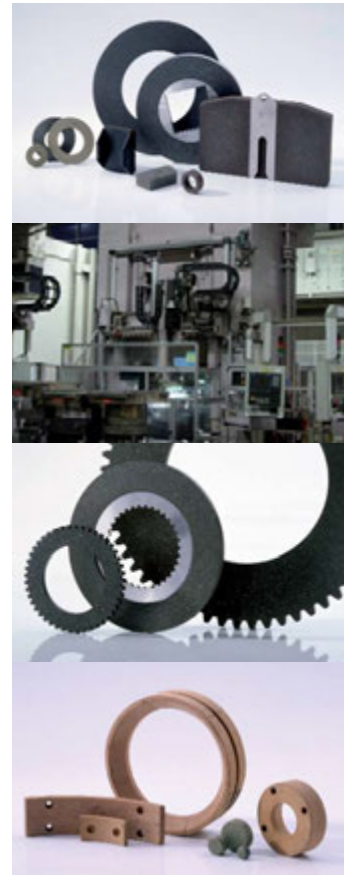
Technical Friction Materials for the Industrial Division

As a competent development and production partner, we also support our customers from the industrial division with regard to all technical friction challenges. We produce over 5.3 million parts every year from more than 40 friction materials which are proven every day in various applications such as mechanical engineering, mechanical drive technology, in the textile industry, for agriculture, or for medical, security, or sanitation technology, and often under the most difficult operating conditions.

The product range includes simple rings, rings with internal gearing, cones, conveyors, and friction blocks or segments, often as security parts, which are pressed, rolled, or manufactured using injection-moulding processes.

Our many years of experience in the automotive industry provide comprehensive testing facilities able to verify the lifetime of products before they are used in practice. The highest level of quality is guaranteed through production on modern machines.

We make sure materials are selected that are generally recognised as safe when considering the raw material composition. All of our industrial materials are free of asbestos and heavy metals, and have been manufactured without solvents for many years. Our specialists are available for our customers for the service life of the product.



Forward thinking friction materials for electromagnetic motors, cranes, and lifting equipment (above), for modern form presses (2nd from above), for high-performance clutches in mobile machines (2nd from below) and for raw timber and agricultural applications (below).



"Zero defects" assures us the Top Position in our Daily Business

We feel obligated to our customers to provide the best quality and thus the highest reliability in all products, which drives us daily to better performance.

This goal requires effective quality management which has seamless and economical control in all phases of the company's product production. The highest goals are to produce our products economically and with quality, to guarantee the specifications agreed upon, as well as achieve continuous improvement in performance and quality using a continuous improvement process. A quality management system per ISO/TS 16949:2002 including DIN EN ISO 9001:2000 was introduced in our company to fulfil customer requirements agreed upon for planning, implementing, monitoring, and improving all quality-relevant activities and for improving customer satisfaction. This is practiced in the entire company.

Sustainable Development for our Environment

Environmental protection is part of our company policy. We are constantly working to improve existing manufacturing processes and develop new ones that take a minimum toll on our environment. Our forward thinking "LMF" technology, the solvent-free yarn impregnation, emits 80 % less CO₂ than the conventional method with solvents, due to significantly less energy consumption.

Environmental protection is also an important part in the performance specifications for material development. The TÜV Eco certificate per ISO 14001:2004 confirms that we are making great efforts here.

It is also our policy to pursue continuous improvement in operational environmental protection above and beyond the minimum requirements specified by laws and pertinent environmental regulations. Each employee can measure his daily work by these demands – for one environment for tomorrow.