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LAYER

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The Future of the Automotive Industry

Which Solutions Help to Advance the Sector?

Combined Strengths: Combination Treatment of Plasma Nitriding and PVD Reduces Production Costs

Core Values for a Strong Future: Flexible, Close-to-Customer and Close-to-Staff – the Basis for Long-Term Partnerships

The Automotive Future

Designing Together

Dear business partners,

Valentin Bühler
Managing Director

Prof. Dr. Stefan Bratzel
Head of the Center of Automotive at the University of Applied Sciences (FHDW) in Bergisch Gladbach

In this edition our focus will be on the automotive industry. The industry is currently undergoing a "paradigm shift", as the expert Prof. Dr. Stefan Bratzel calls it. I had the opportunity of talking to him about trends, future markets and the role of surface technology.

Valentin Bühler: Professor Bratzel, how would you characterise the future development of the global automotive industry?
Prof. Dr. Stefan Bratzel: The conflicting poles of emerging markets – particularly in the BRIC countries – on the one hand and stagnating Western markets on the other will be shaping the future even more than before. Established companies will have to adapt their products and services to the needs of these emerging markets while at the same time compete with new players; this holds true for both manufacturers and component suppliers. In order to subsist in the long run, a certain strategic size will be necessary, a size that today only a few manufacturers such as Volkswagen or Toyota have. Overall, we will be seeing increased concentration in the market. The number of independent companies will decrease while new players coming from the emerging markets will be claiming market shares.

Valentin Bühler: What technological challenges will the industry have to meet?
Prof. Dr. Stefan Bratzel: Global megatrends will be affecting the automotive industry too, first and foremost the topics energy efficiency and CO_2 reduction. Existing traditional engines have to become more efficient, while alternative engines will become more important. Low-cost motor vehicles and so-called first car ownership are further important topics. Both areas exert demands on established companies to provide structures for maximum cost-efficient production – including local operations within the growing markets.

Valentin Bühler: How can the industry benefit from surface solutions in facing these current challenges?
Prof. Dr. Stefan Bratzel: The core question concerning coatings is: How does a solution correspond to big trends? Surface solutions that significantly contribute to efficiency increases in production and application will automatically become an important and necessary part of the automotive future.

Valentin Bühler: Professor Bratzel, thank you for the brief forecast.

On the following pages, read about how and in what areas Sulzer Metaplas' innovative solutions contribute to greater efficiency and profitability in the automotive industry.

Your **Valentin Bühler**
Managing Director

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Efficiently and Eco-Friendly Driven

While developing alternative drives, the optimisation of existing technologies is crucial for creating an automotive future that is as efficient and environmentally friendly as possible. The targeted treatment of parts with IONIT®, IONIT OX® and DLC coatings decisively contributes to a good energy balance of engines and powertrains.

The dual clutch transmission is a good example. “It uses the best of both worlds”, states Rolf Heinecke, Salesmanager IONIT®-Service at Sulzer Metaplas. “This technology combines the particularly smooth riding comfort of an automatic transmission with the good fuel efficiency of an automated manual transmission.” Key reasons for the efficiency of the dual clutch transmission are, amongst other things, the good friction characteristics and the longevity of the components. From the outset, Sulzer Metaplas and Sulzer Friction Systems were involved in the development of dual clutch transmissions, in close cooperation with the automotive industry. The surface solutions improve the properties of components such as gearshift lever shafts, disc carriers and synchroniser rings in a targeted way while reducing manufacturing costs at the same time. With the application of IONIT®, IONIT OX®, DLC coatings or process combinations (see report on page 6), in many cases manufacturers can use alternative materials. This has various advantages: Cost savings in material sourcing are possible – expensive, high-alloyed steels are →

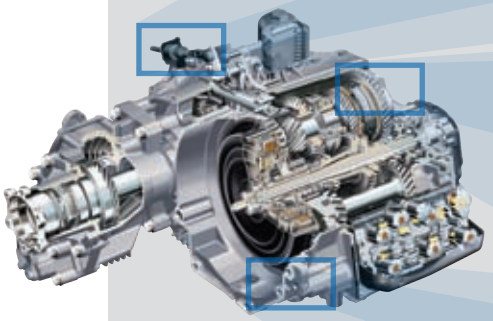
Efficient and environmentally friendly

Components

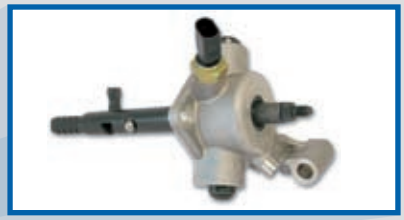
- Corrosion protection
- Strong wear resistance
- Improved abrasion parameters
- Environmentally-friendly coating process

Manufacturing process

- Reduction of vertical integration: production steps made obsolete
- Substitution of expensive materials
- Use of easy-to-form materials



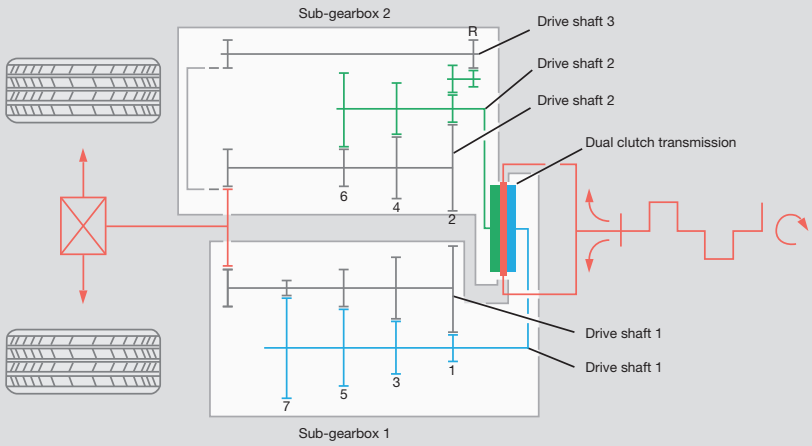
Sectional view of a dual clutch transmission



Gearshift lever shaft treated with IONIT OX®

Synchroniser technology

Disc carrier treated with IONIT®



Schematic view of a dual clutch transmission:
The fully automatic gear shift between the two sub-gearboxes in one transmission housing provides for gear-shifting without interruption of traction. This makes for smooth ride performance with good fuel economy thanks to the high degree of system efficiency.

Page 3 continued:

substituted. In addition, the production process becomes more efficient: The application of materials that can be more easily processed makes certain mechanical processing steps obsolete.

“Due to climate change and the growing shortage of fossil fuels and resources, constructors are confronted with major difficulties”, Martin Fromme, Head of General Engineering Parts & High Volume PVD at Sulzer Metaplas, forecasts.

However, as the market penetration of alternative engines and drives (e.g. electric motors) will still take some time, efficiency gains of contemporary parts are of key importance. Significant potentials can be generated in the targeted friction optimisation of components. Low-friction DLC coatings contribute decisively to improved engine efficiency as well as to CO_2 reduction. Due to lower friction losses in the engine, the coatings compensate the efficiency losses caused by increased environmental requirements such as higher ignition pressure levels as well as exhaust gas recirculation.

„The surface solutions improve the properties of components in a targeted way.“

With valve trains and bucket tappets, too, DLC coatings improve abrasion and wear properties. Due to the strong wear resistance and the excellent oil film, the smooth surface remains intact.

An outstanding example for a coated engine system is the common rail technology – with its ideal fuel utilisation and improved engine exhaust values. In this system, the DLC-coated pressure pistons, injector needles and valve seats counteract the enormous wear through increased contact forces and accompanying narrower lubrication gaps.

In power train engineering, for instance with gear transmissions, strain and circumferential velocity define the respective signs of wear and causes of failure. The DLC coatings increase the fatigue strength by 10-15 percent against merely case-hardened gear wheels. The reason for this is also the low friction coefficient of less than 0.15, which reduces the local surface pressure and effectively reduces pitting effects. With sun gears of automatic transmissions, differential components and starter pinions, too, high strains and disadvantageous lubricating conditions (cold starts, mixed friction) lead to wear that is averted by DLC coatings.

"Regardless of what kind of surface refinement is applied – a sustainable automotive future can only be shaped with targeted improvements of existing engine and drive technologies. Sulzer Metaplas is part of this development – and we continue to feel responsible for contributing to efficient and environmentally-friendly mobility with our solutions", is how Rolf Heinecke describes the company's perspective. ■

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Sustained reduction of friction and wear

DLC coating systems for parts subject to high stress increase the efficiency and reliability of engines and drive trains. The following components are coated:

Engine

- Valves (valve trains, valve seats)
- Bucket tappets
- Pressure pistons
- Injector needles
- …

Drive train

- Gear wheels
- Sun gears
- Differential components
- Starter pinions
- …

DLC coating advantages

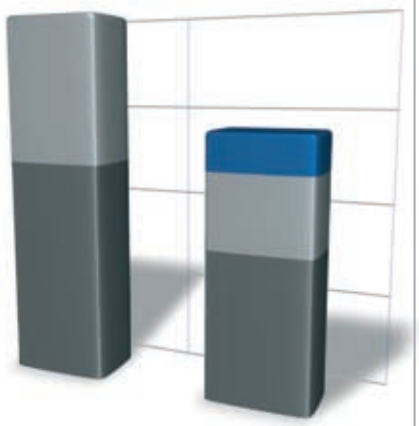
- Only one of the friction partners has to be coated
- Significant increase of scuffing load capacity
- Wear reduction
- Increase of micropitting capacity
- Optimised dry-run operation features
- Coating of bearing seats possible
- Minimisation of operating noise
- Coating temperature ≤ 200 °C

DLC coated components reduce friction losses and thus increase the efficiency of engines and drive trains.

Combined Strengths

The combination treatment of plasma nitriding and PVD enables the substitution of expensive materials and thus reduces production costs in automotive component manufacturing. The advantages of this technology are also applied in other industrial sectors.

Significant reduction of production costs



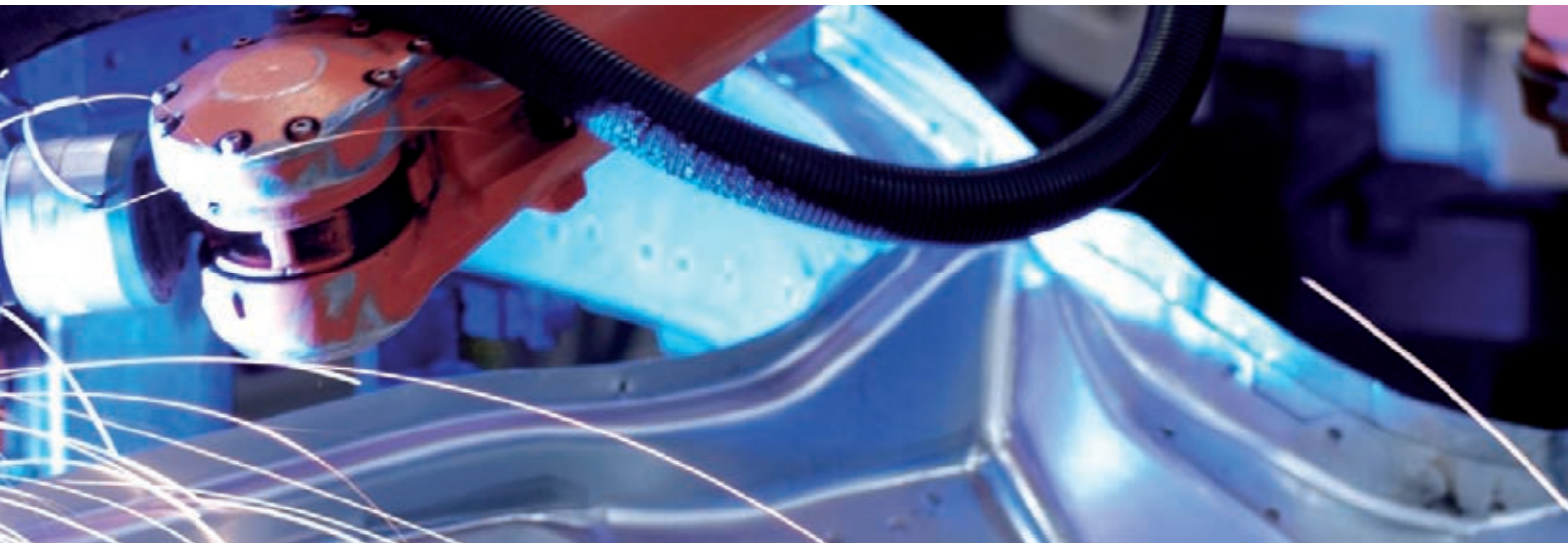
Combination-treated components, by way of lower material costs (substitution of expensive materials) and a decline in processing costs (redundant fabrication steps), significantly reduce production costs.

"If you told a production manager he could work with materials that are more cost-effective and simultaneously reduce the number of manufacturing steps – how do you think he would respond?" This merely rhetorical question, formulated by Dr. Thomas auf dem Brinke of Sulzer Metaplas, illustrates the advantages of a customised combination treatment: In the area of components for engine technology, particularly in the automotive sector, increasing and difficult to calculate material costs for high-alloyed steels play a decisive role for the overall production costs. In addition, these materials are relatively difficult to process – a further factor that inflates production costs. The combination treatment of plasma nitriding and PVD coating equips the more cost-effective materials for higher degrees of strain. As the materials are easier to process, certain fabrication steps can be dropped completely.

„Reducing costs and improving the component properties."

Besides cost reductions, the combination treatment optimises the properties of the components in their application. Due to their coating, they are protected against corrosion and wear and are thus significantly more durable. In addition, their friction parameters are improved. This is due to the plasma nitriding coating that is applied directly on the substrate. The coating gives the PVD layer, which is applied in a second step, the necessary supporting effect (see diagram in grey box on page 7 top). The advantages also become apparent in areas going beyond components.

When the combination treatment is used in forming, tool life can be increased by a factor of two-and-a-half in comparison with tools that have been simply coated. In forging, for example, the base material obtains an increased heat resistance through the plasma nitriding. "For us it is decisive that the customers know that their tools and components respectively are in good hands at Sulzer Metaplas. We have been dealing with plasma nitriding and PVD for decades – we know the requirements of the various industries (overview of the sectors in grey box on page 7, editor's note) regarding



the handling and the surface treatment of their tools and components", emphasises Dr. Thomas auf dem Brinke in pointing to the importance of experience and expertise.

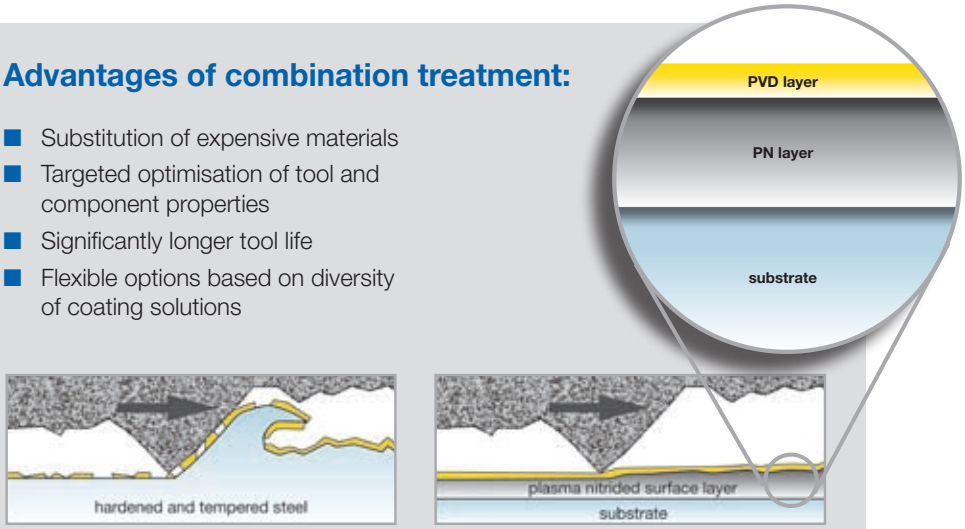
This also holds true for the plastics industry: The wear mechanisms arising from the additives in plastics as well as inappropriate cleaning of tools are significantly reduced through the combined plasma nitriding and PVD layer – and the operators benefit from longer tool life. Sulzer Metaplas even performs coatings of long parts such as extruder screws up to length of 4,500 millimetres using systems technology that is unique in Europe (see story in LAYER issue 2/2009, page 6-7).

Besides the plastics industry, forming and the automotive industry, the combination treatment also pays off with certain machining tools such as hob cutters. With these relatively expensive tools, know-how concerning the whole process chain – from pre-treatment to the coating process right up to the surface finish – is extremely important. Through many years of experience, the staff at Sulzer Metaplas have an eye for the special handling aspects that need to be observed.

Dr. Thomas auf dem Brinke: "The diversity of coating options opens up many possibilities beyond the application examples mentioned. On the basis of personal consultations with our customers we always find the best solution for the specific case. During consultations we maintain an open eye for the customer's requirements – reducing costs and improving the component properties." ■

Advantages of combination treatment:

- Substitution of expensive materials
- Targeted optimisation of tool and component properties
- Significantly longer tool life
- Flexible options based on diversity of coating solutions



The comparison shows: A plasma nidrided surface considerably improves the supporting effect for the PVD coating.

Application areas:

A customised combination treatment of plasma nitriding and PVD coating provides for significant efficiency gains in the following application areas:

- Forming
- Plastics processing
- Components
- Machining
- ...

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Core Values for a Strong Future

Flexible, close-to-customer and close-to-staff – the basis for long-term partnerships

Engin Demir, operations manager for PVD service sees Sulzer Metaplas' staff as a key to success: "We have great confidence in the performance of each individual. For us, regular exchanges, transparent structures as well as continual advancement and further training of our employees is a matter of course. Teambuilding takes place in a targeted way along individual expertise. This means that the strengths of employees complement one another ideally which can be seen, for example, in our research and development team (see story in LAYER 1/2009, editor's note). With their know-how, the specialists are in the right place at the right time." LAYER issue 1/2008 described what this means in detail: Everyone is included in the improvement process and thus decisively contributes to the overall success of the company – employees are also "co-entrepreneurs". This is a result of working with Porsche Consulting: noticeable for customers through optimised quality, delivery reliability and prices in line with the market.

Interaction in the team is promoted through regular workshops on technical issues and social competency. This keeps everyone up to date and enables them to act professionally. To ensure this, team members know the work flows of their colleagues. But this transparency does not only hold true for the internal perspective: every customer has fixed contact persons who provide comprehensive advice and active support.

In the context of project management, all processes are continuously improved and optimised with a lean process design, from incoming orders to delivery. This makes for short reaction times as well as high quality surface solutions and plant technology. Continuous improvement is not an end in itself: Customer-specific solutions in coating service are the result of extensive market investigation and close cooperation with customers from the following sectors: automotive, plastics processing, forming, machining etc.

The systems engineering expertise is passed on to users, customer operating staff and Sulzer Metaplas employees by experts in training workshops. Regular maintenance prevents production downtimes and costly shutdowns. Alexander Mohnfeld, Head of Sales Service PVD: "Our coating service solutions effectively reduce our customers' manufacturing, production, equipment and material costs. The interplay of customer proximity, operational excellence and committed staff (see figure, editor's note) unleashes further potentials." ■

Customer Partnership

- We are reliable partners.
- We provide a high level of service.
- We make our customers more competitive.

Operational Excellence

- We focus on results.
- We take initiative and work within established processes.
- We act safely.

PEOPLE

Committed People

- We drive accountability.
- We are open and transparent.
- We are team players.

From a staff perspective: the Sulzer values in a threefold interplay – the people being in the centre

Change-over in Niederwürschnitz

Lothar Eidam hands over to Bernhard Reisert

After thirty-six years of active service at Sulzer Metco, Lothar Eidam (third from the right) was bid farewell by Sulzer Metco's President César Montenegro, the Managing Directors of KOKI TECHNIK, Bernd and Nico Beltrame, Rolf Heinecke, Sales Manager IONIT®-Service as well as Sulzer Metaplas' Managing Director Valentin Bühler (from left to right) during a festive evening event.

After a total of 36 years in the company, Lothar Eidam is going into well-earned retirement. In the past six years, he has successfully managed the Niederwürschnitz location. Bernhard Reisert, until now operations manager in Bergisch Gladbach, will be his successor.

Mr. Eidam began his career at Sulzer Metaplas with the company formerly called Klöckner IONON GmbH. Initially trained as a precision mechanic and electrical fitter, he now looks back on over forty years of experience in hardening and plasma nitriding. This competence decisively contributed to the success of the Niederwürschnitz location.

Bernhard Reisert is the new Niederwürschnitz site manager

He will be handing over to his successor Bernhard Reisert, who was operations manager at the Bergisch Gladbach location up to now. Mr. Reisert collected extensive experience in the automotive industry in the area of heat treatment. Trained as a general hardener, he has already worked as a workshop manager in the metalworking industry. This is a good foundation for continuing to expand the positive development of the location.

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Overview of Annual Results

Find out about the annual results for 2009 on the internet at:

www.sulzer.com

in the section „Investor Relations"

Exhibition Dates

More information on expert conferences and exhibitions that Sulzer Metco and Sulzer Metaplas respectively will be attending on:
www.sulzermetco.com
(section: About Us/News/Events)

Getriebe in Fahrzeugen 2010
Friedrichshafen, Germany
22. – 23. June 2010

IMTS 2010
Chicago, USA
13. – 18. September 2010

AMB
Stuttgart, Germany
28. September – 02. October 2010

Härtereikolloquium
Wiesbaden, Germany
13. – 15. October 2010

K 2010
Düsseldorf, Germany
27. – 03. November 2010

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