SULZER

Sulzer Metco

LAYER

1/2011 The Magazine of Sulzer Metco Thin Film

Developments for Champions

To the Top Together

High Technology Serialised:
From Racing to Mass Production

The Wide World of Small Chips:
Solutions for Efficient Semiconductor Production

Gentlemen,

Start Your Engines

Valentin Bühler
Managing Director

Dear business partners,

What characterizes a successful Formula 1 or NASCAR team?

Overwhelming ambition, absolute perfection, optimized teamwork and professional strategies – with these attributes one wins races. However, to gain victories for the long-term and keep the lead permanently constant improvements are necessary. Staying ahead means constantly advancing technologies with sound prospective actions. Not only for racing is this true: Real champions go for more than only occasional victories – they desire to win championships. Proud of their achievements: yes! Satisfaction: no!

Our automotive customers benefit from our successful partnership with Formula 1 and NASCAR teams for their serial production. On the one hand it is all about fighting for every split second lap by lap on the borderline and on the other hand the focus is on CO_2 reduction. How both businesses take advantage of similar solutions despite their different requirements you can read on page 3.

The top world-class teams synchronize the perfect interactions between technique and timing which decides of victory or defeat, champagne or gravel pit. In other words: An efficient solution consists of more than one product or one convincing technology. Those fulfilments and information which are part of the One-Stop-Shop solution for racing and more can be read on pages 6/7.

Let us turn your attention from the high speeds of racing, to scientific developments in the semiconductor industry. Read on pages 8/9 how solutions from Sulzer Metco's Thin Film division of diamond-like carbon coatings (DLC) contribute to the rise in quality and efficiencies, in this industry. The improvements in gigabytes and nanometers, realized with these coatings in the semiconductor industries, are equivalent to increases in horsepower or saving lap timing.

Besides our products and services, our experts are the ones finding individual solutions together with our customers: Get to know our sales team and the right contact person for your business (page 10).

We already managed some quick laps, but we have not reached the finish-line yet. We will continue furthering our efforts to provide the solutions you require of us!

Your Valentin Bühler
Managing Director

High Technology Serialised

Surface solutions from racing industries become more important in automotive mass production.

Both have four wheels and drive on paved roads. Both are driven by engines and both are reliant on advances in innovation. The Formula 1 car and the mass production vehicle are related but different in many cases. Simplified: There is little opportunity to face a Formula 1 car on the highway, but we meet more Formula 1 technique on public roads. How does this technology find its way from the racing track to the highway? How can these different needs, like more horsepower in the motorsports and CO_2 reduction in the mass production vehicle be met with the same approach?

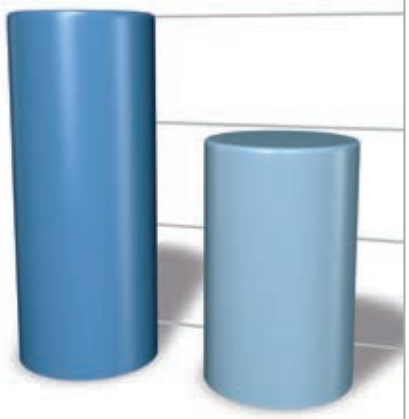
"The performance was higher than expected."

The finishing of some components with DLC coatings is one of the important steps in fulfilling the growing requirements for modern engines and gears. Many customers are surprised how little investment is required in customizing their coatings. Due to the flexibility of the technology the users often do not require any special adaptation to apply the coatings to their parts or components or if necessary to a minor degree. If required, generally a slight modification of the surface finish is enough to prepare tools for DLC coating. The major development work is done by the experts of Sulzer Metco Thin Film.

"For the motorsport this is generally valid: The finishing of special tools with CAVIDUR® is just one step in the developing of high speed engines. But the fact is this high speed could not be realized without coatings", Mark Boghe, Segment Manager Racing at Sulzer Metco Thin Film, points out the importance of coatings for improved performance and more efficient engines in racing. Practice has already proven that coatings have exceeded all expectations. Today every Formula 1 team uses customized CAVIDUR® coatings for special components. "The performance was higher than expected. The expertise we established in more than 15 years of collaboration with Formula 1 teams helps manufacturing of mass production vehicles now", explains Mark Boghe.

These advantages benefit the automotive industry. Customers profit from the commitment in racing. "Our work for Formula 1 and NASCAR is not a prestigious project – quiet the contrary: the high tech solutions for racing often point the way forward. We make innovation and solutions available for mass production", underlines Mark Boghe. Coatings are applied in different applications and for some extend or complete parts. ➔

Significant friction reduction



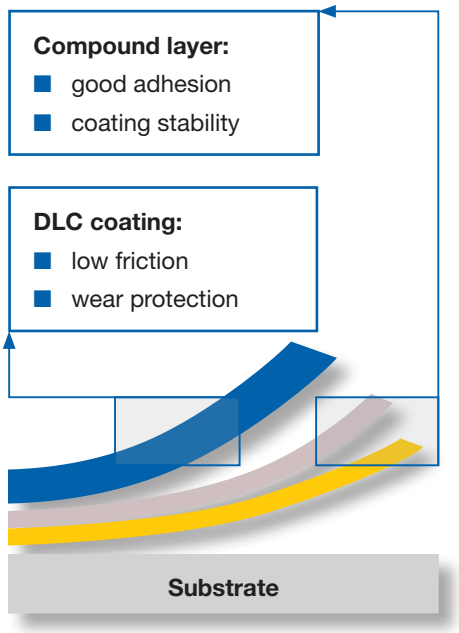
Uncoated parts DLC coated parts

For mechanic valve tappets friction can be reduced by one-third, depending on the required torque and temperature.

Page 3 continued:

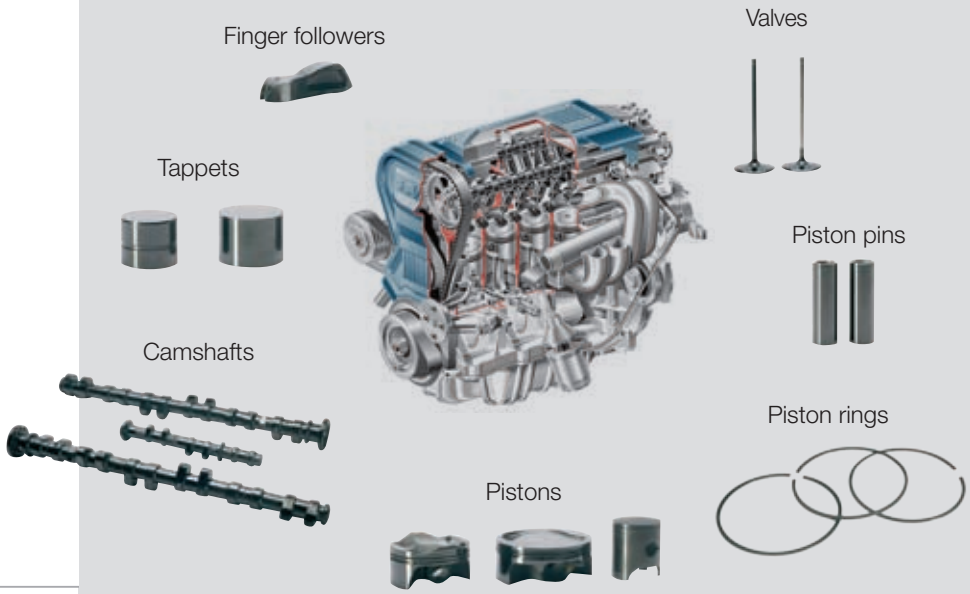
Whole manufacturing steps become redundant. The bearing inside the piston boss for example prevents steel-on-steel friction and becomes unnecessary when the piston pin is DLC coated. The counter part in a racing engine can be designed smaller by the engineers so less construction size is needed. Nearly the same applies to mass production: The bearings are not needed and the production process becomes more efficient. The engine endurance is improved because the bearings are the weakest link of the system.

The DLC coating CAVIDUR® for racing finds its adequate analogy in DYLYN® Plus for mass production. Its development for automotive mass production is based on the racing experience. In cooperation with the PSA-Group (e. g. Peugeot) components of the valve trains have been coated using DYLYN® Plus. The properties of the coating can be customized to the users' requirements. The application of DYLYN® Plus on tappets in small and middle gas engines (e. g. 1,6 litre four-cylinder gas engine from Ford or Peugeot) can reduce the required torque depending on engine temperature and engine speed up to 33 percent. No further design or manufacturing changes on the engine are needed. This improvement leads to less fuel consumption in a small single-digit percentage range plus a reduction of CO_2 emission up to 2 to 3 gram per kilometre. This is an important factor for the upcoming more strict requirements: Starting 2015 a fine of 95 Euros for every gram above the limit has to be paid. Looking forward in automotive development reduction of friction losses still bears a huge potential. Besides DLC coatings also PVD coatings account for that – in Formula 1 as well as in mass production. Exhaust valves are coated with CrN because of increasing temperature requirements. Coatings reduce friction losses and improve energy efficiency. The efficiency of engines typically increases with the number of coated components used. Low friction – the minimization of friction losses will remain as an important topic in these businesses – whether for more speed or for saving fuel. ■



Optimized Friction

The coating of different components of the valve train and piston parts with DLC leads to a reduced friction coefficient. This causes reduced fuel consumption, increased life time and speed – verified to the individual requirements of racing (CAVIDUR®) and mass production (DYLYN® Plus). Following parts are coated:



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“We Make Champions!”

Andrea Hürlimann and William Kimberley discuss the importance of coatings in racing and automotive.

Andrea Hürlimann
Head of Segment Management
Sulzer Metco Thin Film

William Kimberley
Chief editor of
the magazine Race Tech

LAYER: How important are DLC and SUME*Bore*® coatings in racing?

William Kimberley: Over the years racing has driven the automotive industry with developments like multi-valves engines, downsizing of high-rev engines, using innovative materials for reducing the effective mean braking pressure, allowing high compression ratio and super-charging. One of the major inputs of racing industry has contributed to the automotive in the reduction of friction. Friction – the greatest enemy of engine performance - will be a major challenge for engine designers in the future. DLC and SUME*Bore*® coatings will play a more important role for friction reduction in racing series.

Andrea Hürlimann: Yes – and on 1 July 2010 two coating pioneers unified their strength: Sulzer Metco and Sorevi. With our expertise in the industry we are able to push the development for our customers and create added value on multiple levels: Due to reduced friction our solutions offer improved performance and increased reliability. Our contributions to weight reduction and corrosion resistance are further arguments for the increasing importance of coatings. We are proud to make champions!

LAYER: How would you evaluate the future importance of coatings in racing? How will their importance work out?

William Kimberley: In the past coatings were well known with top teams, but this technology is no longer a privilege for the high budget racing series and teams – finally the benefits are obvious for everybody. Therefore I think, technologies like DLC will play a big role in racing cars furthermore (engines and gears). Meanwhile in every area of this sport there is a driving force to advancements – to coat parts that have not been coated before.

Andrea Hürlimann: I share Williams views: Already today we have working solutions for the coating of additional parts in and outside the engine for improving efficiency and performance. The corporate development of individual solutions helps everyone involved: We expand our expertise continuously and customers benefit from optimized solutions. Besides customized solutions for high tech teams in Formula 1 and NASCAR we also offer solutions for smaller racing series and standardized solutions for hobby race drivers.

LAYER: How do you think the manufacturers of mass production vehicles can benefit from to developments made in racing?

William Kimberley: The development and the practical use of coatings is something automotive industry has adapted from racing – especially for high performance cars. In my opinion this process will expand on middle and small cars in the future.

Andrea Hürlimann: We are here from the start of coatings in racing and additionally we bring along experience in mass production. We are well positioned for the progress predicted by William and also have a view on our expertise in CO_2 and weight reduction. Thereby we make an important contribution to better environmental balance of automobiles. Likewise we are well prepared – personnel and technology-wise – for future challenges, thanks to the cooperation with the automotive and engineering industry. ■

SUME*Bore*® – Thermal coating for cylinder walls

A further step to CO_2 and friction reduction is coating of the cylinder walls with SUME*Bore*® technology by Sulzer Metco. Such coatings – as well as CAVIDUR® – are used in racing and mass production with success: from Formula 1 and NASCAR cars to sports cars (e.g. Bugatti Veyron and Aston Martin One-77) and mass production cars (e.g. Volkswagen). These thermal sprayed SUME*Bore*® coatings have proven over ten years, in the beginning in racing, later also in mass production. The coating characteristics are balanced by requirements for performance improvement (racing) or for emission reduction (mass production). Beyond that corrosion resistance can be improved if necessary. In Aluminium engines cylinder liners are unnecessary when coated cylinder walls with SUME*Bore*® – weight and size of the engine can be reduced significantly. The interaction with a thin film coating (PVD or DLC) by Sulzer Metco Thin Film for examples of the piston ring or piston skirt are used optimize the efficiency even more. ■

A Winning Start

The clients of the racing business benefit from the One-Stop-Shop solution of Sulzer Metco Thin Film. From the consulting of pre-treatment and coating to surface treatment customers get all from one source.

You cannot win a race after only one lap – but loose it. From the start of a race to the finish line the reliability of the system is what counts. The racing teams paved the way for successes in the past. Primarily, an optimum balanced overall technical concept and smooth procedures enable the driver to win races or at least to make it through. "The coating process for customers in racing is similar. It is not enough to concentrate only on the actual process", says Mark Boghe, Segment Manager Racing at Sulzer Metco Thin Film. "Our job covers everything from the receiving of a tool to the final shipping. Besides the resulting quality advantage customers benefit from the simple actions they receive, all from one source. We take over process steps that our customers can not or don't want to organize themselves. Additionally, our 10 years of experience in racing industry assures customers of proper handling practices."

"The customers benefit from logistic and quality advantages."

Mark Boghe summarizes the advantages of the One-Stop-Shop solution for the customers: "Our long growing expertise for the safe pre-treatment and after-treatment as well as the quality and reliability of the surface are just the basics for our special concept. It is crucial that we offer the whole technology and business activities consolidated – both for European and American customers." This way customers benefit from logistic and quality advantages. The general delivery time is one week – urgent parts can be coated over night.

Back to the start: Each single action in the chain of events to success is not deciding on a reliable functional part. Every action has to be taken with accuracy and precision. This is the only way to win races. ■

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Starting with the **incoming department** and the **incoming inspection**: What are the specific characteristics of the tool? What has to be considered during the following process?

2

The components are cleaned afterwards. The **cleaning and pre-treatment processes** set the basics for good adhesion, optimal surface finish and tool quality. Special features of Sulzer Metco Thin Film are optional additional pre-treatments like polishing or tumbling besides the standard cleaning.

3

Pollution and contaminates on the substrate are removed reliably – for an optimum adhesion so that possibly machining or delivery caused defects can be discovered early in the following **inspection**. A **laser marking** – by request in racing business – on the parts is following: To guarantee later retracing of the parts they are marked individually or by batch.

4

The components are ready for coating after **loading by batch**. For each part design – if required customized – the company develops and designs matching tooling.

5

The **coating process** – a combined PVD/PACVD process – is the core of the process chain. Here the parts get prepared for competition and are customized required to characteristics like e. g. a low friction coefficient or improved wear resistance. You can learn more about the coating process on pages 3 to 5.

6

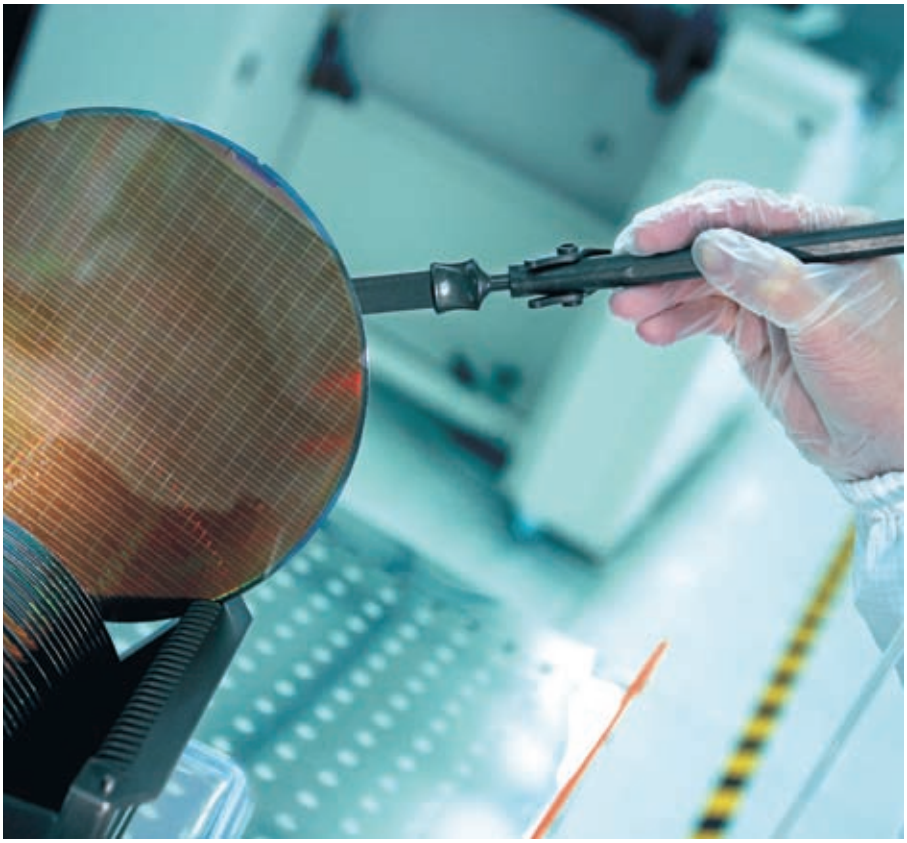
Besides the **visual control** of all coated components each coating process is evaluated by the **analysis of one sample**. So the batch-to-batch quality and the actual process are documented and optimized continuously.

7

Finally the components are **packaged** individually according to customers requirements on the **way back to the customer**.

The Wide World of Small Chips

How can thin film wear resistance surfaces improve the efficiency of Semiconductor/Electronics equipment functionality? How can thin film surfaces improve the efficiency of their production and functionality?



The main drives in today's semiconductor business are low cost, particle reduction and flexibility. Increasingly complex, increasingly smaller – the requirements in semiconductor manufacturing are similar to the automotive industry. The key word "downsizing" moves equally the development departments for both industries, but in very different proportions. For semiconductor manufacturing, low cost requires high tool utilizations, whereas flexibility and the ability to respond quickly to changing customer demands require short throughput times. There is, however, an inherent operational conflict with achieving both high utilization and short cycle time simultaneously. Recommendations for improving performance include optimizing tool design and changing preventive maintenance operations. The continuing trend toward smaller design rules and the emergence of new processes in semiconductor manufacturing have created new process control and yield challenges for chipmakers. As the feature size gets smaller (32 nm node and below), the impact that contamination due to particles has on yield becomes greater. Since yield loss due to particle formation is not desired, avoiding particle formation gets a high focus.

Sulzer Metco Thin Film's end customers in this industry are primarily equipment users and manufactures for the production of Integrated Circuits (IC). In this context, silicon wafers are transformed into IC by a series of deposition (layering), patterning, doping and heat treatment processes. Once fully processed, a single wafer is diced into many small individual components, which are then packaged for use computers, cell phones or other various electronic devices.

Semiconductor equipment components Metal or Ceramic) are coated with a DYLYN® thin film to minimize particle and

metallic ion contamination. More specifically, components are coated which come directly into contact with the wafers such as:

- High-precision parts, wafer handlers and wafer stage (electro-static, vacuum or thermal)
- Cooling pedestals

"More than ten years of expertise as a business partner in semiconductor."

In case of wear of these components caused by wafer manipulations, particles can be generated and this will result in yield loss for the IC manufacturer. The high hardness, low coefficient of friction and excellent wear resistance of DYLYN® coatings directly helps reduce this particle generation.

Other types of parts coated are components used in positioning systems such as:

- Docking components for the precision alignment
- Precision screws
- Grippers

In this case, maintaining the dimensions of tightly tolerance components is of crucial importance for the performance of the tools. For these applications, the DYLYN® coatings prevent the component from wear which can affect overall component dimensions. This is crucial for reproducible quality. If needed, the DLC/DYLYN® coatings can be adapted to meet customer's requirements. For example, various dopants can be added to the coating, such as silicon, which will alter the coating properties. Sulzer Metco Thin Film has more than ten years of expertise as a partner to the semiconductor manufacturing industry.

The semiconductor industry has a high degree of innovation and is very development-focused. The companies in this industry seek to partner with suppliers that are equally innovative and flexible. Sulzer's objectives are in line with this. "We want to be a partner with our customers rather than just a supplier. We want to think with the customer and help develop the next generation solutions. This to guarantee a long lasting successful relationship", explains Johan Palmers, Semiconductor Segment Manager.

"Furthermore, our clean room facilities and handling practices developed over the last 10 years enable us to fulfill the high quality expectations of our customers. We have also implemented a "copy exact" philosophy throughout our entire manufacturing process; from incoming inspection, thru cleaning, coating, outgoing inspection until packaging, to ensure that we consistently deliver coated product that is in accordance with our customers specifications." ■

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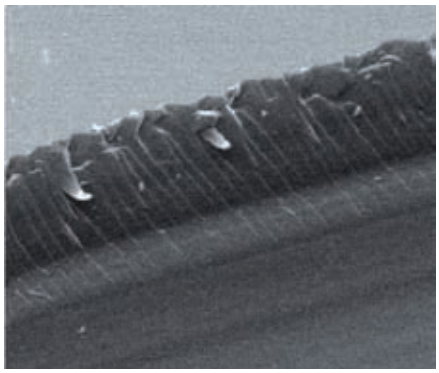
PACVD equipment integrated in a clean room for high purity DLC coatings



Build of low friction DLC coating

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The Sales Team of Sulzer Metco Thin Film

Living Success Together

Customers and users have one special contact person for each industry.

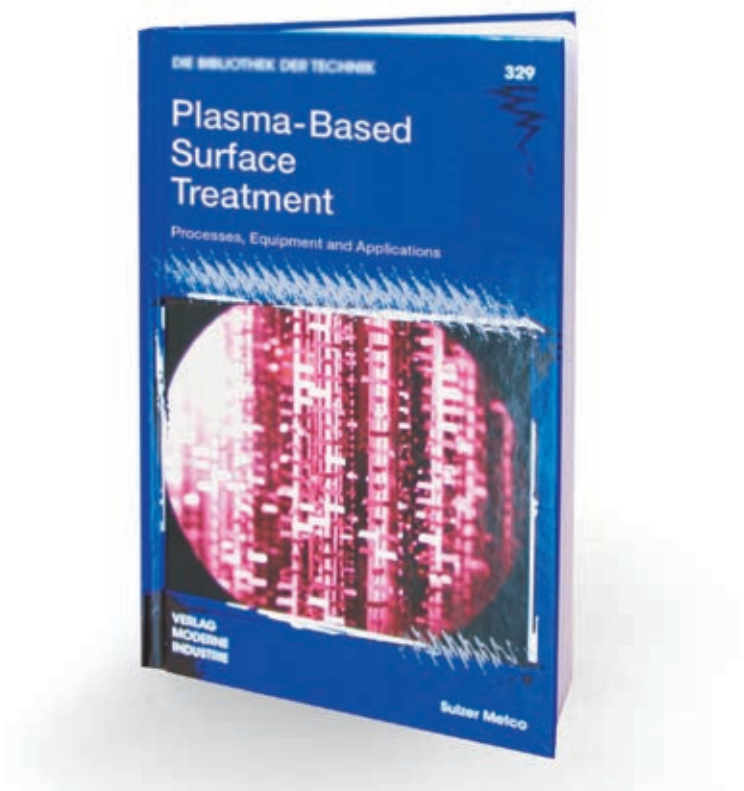
At Sulzer Metco Thin Film they present the connection between technology and user. The members of the sales team have a common challenge: To find custom-made solutions in close collaboration. Each business has its own expert contact person, who brings specific solutions to customer problems.

"We are able to find a solution for every problem"

In the long term every involved party benefits from this cooperative partnership: "We know our customers and their daily challenges. With our broad technology we are able to find a solution for every problem – whether plasma heat treatment, PVD, DLC or specific combination treatments. The result of our business expertise and our technological know-how is a qualified and customized service. Finally we contribute to the success of our customers", summarizes Andrea Hürlimann, Head of Segment Management at Sulzer Metco Thin Film. ■

The New Standard Reference

The new reference book from Sulzer Metco Thin Film provides important information about plasma-based surface treatment.



Practical relevant and clearly represented – Sulzer Metco Thin Film presents its new reference book about plasma-based surface treatment. Specialists from research, development and application finalized an overview about the different aspects of the process. Based on basic information the application in every business as well as the functionality of the technology and the coating solutions are presented and explained. Interested persons may download the book at thinfilm.sulzermetco.com/download.html or get a free copy by sending back the attached questionnaire. ■

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Up-to-date

More information, contact details and downloads about all Sulzer Metco Thin Film solutions are available at our homepage:

thinfilm.sulzermetco.com

Exhibition Dates 2011

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)

EMO Hannover 19-24-9-2011

EMO
Hannover, Germany
19 – 24 September 2011

Härtereikolloquium
Wiesbaden, Germany
12 – 14 October 2011

Fakuma

FAKUMA
Friedrichshafen, Germany
18 – 22 October 2011

Professional MotorSport WORLD EXPO 2011

Professional MotorSport
WORLD EXPO 2011
Köln, Germany
15 – 17 November 2011

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