

SULZER

Sulzer Metco

LAYER

2/2011 The Magazine of Sulzer Metco Thin Film

The World of Metalworking

What are the Trends
in this Industry?

Setting Trends:
State-of-the-Art Coating
Equipment Technology

“Optimal for Our
Research Purposes”
TIRI Relies on the DOMINO *mini*

Success Needs Vision

A Simple Formula?



Valentin Bühler
Managing Director

Dear business partners,

It sounds so easy: The key to success is offering exactly what the markets demand.

But is it really that simple? Do we know how the markets will develop in the future? To always be up-to-date and close to the customers, we are in continuous dialog with experts from research and practice. This personal contact is indispensable. Talking to end-users and customers gives us the improved knowledge and insight into the needs of the industries.

Thereby we get closer to the knowledge of what is driving the markets today and in future. Ideally, we are already working on solutions available today that our customers will need tomorrow.

The upcoming leading world trade show for metalworking, the EMO, is an additional catalyst for customer dialog. Leading into this event we've spoken to experts in these fields. We don't want to keep back these conversations from you: Find out more about trends and developments of this industry as well as properties and application possibilities, of our coatings for machining and forming (pages 3 to 5).

Real solutions are presented in the categories Processes and Applications (pages 6 and 7): Which benefits are offered by the METAPLAS-DOMINO systems? What possibilities are available through these technology modules?

In the customer portrait on pages 8 and 9, Dr. Masahiro Kawaguchi reports on his experience with the new METAPLAS-DOMINO *mini*. He describes the cooperation and joint development work, trainings and reasons for the decision made by the TIRI Institute.

For everybody who can't make it to the EMO, Andrea Hürlimann summarises our presentation on this event (page 10). At the same time he gives an outlook for what Sulzer Metco customers can expect in the future; in particular this includes intensive contact and productive discussions with you!

For all of you who will attend the show in Hannover from 19th to 24th September: We are pleased to welcome you to the EMO 2011. Visit us – it's that simple!

Your **Valentin Bühler**
Managing Director

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Coatings Unleash Enormous Potentials

On the occasion of the EMO 2011 LAYER talked to Dr.-Ing. Jens Köhler, Department Manager of Production Processes at the IFW in Hannover about developments and trends in metalworking industry.



*Dr. Jens Köhler,
Department Manager of
Production Processes*

LAYER: Please describe the field of activities and core competence of the institute. What are the IFW experts working on?

Dr. Jens Köhler: We are dealing with everything included in the machining production technology: starting with the machining process itself. We are also involved in the machine development, production planning and organisation – both in theory and practice.

LAYER: Which current challenges are paramount at the moment?

Dr. Jens Köhler: High-temperature resistant and difficult to machine materials, like Titanium alloys as well as alloys for aerospace industry are important topics. How do you increase productivity for the related machining processes? For machining of large components made of Titanium up to 95 percent of the raw material are chipped. In the aerospace industry the riveted holes are an important challenge: The current drilling tools operate to about 400 holes. If you consider that several tens of thousands of holes are necessary for one part you can imagine how much improvement potential is available.

LAYER: Potential, that could better be retrieved with the help of high-perform-

ance coatings. How close do you work together with companies like Sulzer Metco Thin Film in this context?

Dr. Jens Köhler: In particular we do not develop coatings and therefore we benefit from the competence and capacities of such companies. In cooperation with tool manufacturers and coating suppliers, like Sulzer Metco Thin Film, we analyse the performance of coated tools. We test the potential that can be developed due to the coating: how the coating can be used in practice and which market opportunities can be utilised. Thanks to – among other things – new coating systems it is possible to meet the demands of flexibility and increased productivity, especially in single piece production.

LAYER: What are the topics for the future? What will be the innovations in the next years?

Dr. Jens Köhler: A dominating issue of the next years will be design of the surface zone: The goal is processing of surface properties and qualities of components with best repeatability. In this process coatings are of big importance since they influence surface properties in a decisive way.

LAYER: Dr. Köhler, thank you very much for the interview. ■

IFW

IFW Hannover

IFW Hannover (Institute of Production Engineering and Machine Tools) exists since 1831. It is managed by Prof. Dr.-Ing. Berend Dekana. The major focus is on research and application of machining production processes. Besides base research, application research and development, consulting for industrial companies belongs to the range of service of this institute.

At this year's EMO the institute organises a conference on "New Production Technologies for the Aerospace Sector". The IFW shares besides their own booth an exhibition booth with the nationwide Machining Innovations Network (MIN) and also contributes at the booth of "VDW Nachwuchsstiftung" (promotion of young talent).

Answering Future Questions Already Today

Increased lifetime, higher hardness and better productivity – these central requirements in the machining and forming metalworking industries take the respective tools as well as development departments to or even over the limit.

To advertise services and propagate visions is simple. Important is what is behind these concepts. Besides the employees' knowledge and skills, it is the wide range of technologies which allow Sulzer Metco Thin Film to provide solutions to applications that are not that common today but coming up in future.

Machining

The way a developer and producer of surface coatings can prove his innovation capability best, is in servicing the machining industry. The purposes are to extend the lifetime of more complex tools, to improve the abilities for more complex cutting data, as well as to be more environmentally friendly with reduced waste. The base for the production of high-performance PVD coatings

is the thin film equipment technology, such as METAPLAS-DOMINO (more on pages 6 and 7). The APA-ARC technology allows for a wide range of solutions – that include flexibility and adaptability to detailed applications which are becoming more important. These include for example hard and Titanium machining. Aluminium machining for example benefits from the features of W-C:H coatings. The table below gives an overview of solutions for the most common machining applications.

Forming

Tools and applications for the forming industry are coated with PVD mainly using standard ARC technology. Coated tools provide increased tool lifetime, faster forming speed as well as saving of

cooling lubricants and releasing agents. This is achieved, for example, by higher surface hardness, reduced wear and decreased friction. In the forming industry tool lifetime can be increased by a factor of 2.5 using the combi treatment, the combination of plasma nitriding and PVD as compared to the use of only PVD alone. The table below gives an overview of solutions for the most common forming coatings. ■

Contact person:
Andrea Hürlimann
Head of Market Segments
Tel.: +41 522 623 021
e-mail: andrea.huerlimann@sulzer.com

Machining							
Coating	Composition	Colour	Hardness (HV)	Friction Coefficient Against Steel	Working Temp. (°C)	Recommended Applications	
M _{power}	TiAlSiXN	Copper	3600	0.45	1150	Drilling, milling of stainless steel	
M _{power*}	TiAlSiXN (multi-, nanolayer)	Copper	3600	0.45	1150	Turning, milling of steel 58-65 HRC	
M _{tec}	AlTiN (Al55Ti45)	Anthracite	3400	0.4	900	Drilling of unalloyed steel	
M _{force}	AlCrXN	Steel grey	3300	0.4	1100	Hobbing of alloyed and unalloyed steel	
Saturn	AlTiN (Al66Ti34)	Anthracite violett	3400	0.4	900	Drilling, milling and turning of steels and Ni-Alloys	
TiCN	TiCN (monolayer, gradient, multilayer)	Grey, copper	3000	0.3	500	Threading of alloyed steel, cast Aluminium alloys	
Forming							
Coating	Composition	Colour	Hardness (HV)	Friction Coefficient Against Steel	Working Temp. (°C)	Recommended Applications	Plasma Nitriding Recommended
F _{fusion}	VXN	White gold	2200	0.3	650	Aluminium die casting	
CrN _{multi}	CrN (multilayer)	Steel grey	2500	0.35	650	Die casting, moulds	yes
CrN _{mod}	CrN (multilayer with toplayer)	Rainbow	2500	0.3	700	Aluminium and austenitic steel for sheet forming, massive forming	yes
DLC	DYLYN®/DLC A	Black	3000	0.15	300	Aluminium forming	yes
W-C:H	W-C:H (on hard coatings)	Black	1000–1500	0.15	350	Sheet forming, massive forming, hydroforming	yes



The Content of Titanium Alloys Constantly Grows

Dr.-Ing. Matthias Lange, Head of Technology and Tooling at Premium AEROTEC GmbH, talks to LAYER about trends in metalworking for the aerospace industry. The coating technology plays a decisive role.



*Dr.-Ing. Matthias Lange
Head of Technology
and Tooling
Premium AEROTEC GmbH*

LAYER: Dr. Lange, please describe the everyday life in your production for our readers.

Dr. Matthias Lange: In one of the most modern machining centres in Europe complex components of Aluminium, steel and Titanium for all types of the airbus-family, the military transporter A400M and the Eurofighter are manufactured in Varel. The high-performance machining takes a dominant role in the manufacturing process of parts and integral components. These are used for structural and peripheral components in the aircraft industry. Due to small lot sizes and a wide variety of parts most components are made out of sheet material. High-performance milling is the main technique used with an amount of 95 percent. For facing global competition more efficient tools and processes are urgently necessary tailored to the range of parts for the high-performance machining centres. A continuous development is ongoing.

LAYER: How big is your dependence on continuous development of the tools due to the high quality and security standards in your business?

Dr. Matthias Lange: Of course in the aerospace industry the main focus is on meeting the standards. Therefore very high process reliability for developments of tool concepts and milling strategy is required. In particular in machining of tough materials like Titanium alloys local excavation of material of the cutting edge can be prevented by tailored tool coating.

LAYER: Please describe due to your special production situation the meaning of coatings as a part of the "tool system".

Dr. Matthias Lange: Coatings are very important for heavy machining of Titanium alloys, for example, like those coatings offered by Sulzer Metco Thin Film. In this area the local machining temperature at the cutting edge limits the performance of conventional cutting processes and lifetime. Hard coatings can lead to lower thermal stress of the hard metal substrate, higher removal rates and/or increased lifetime of the tools.

LAYER: Which potential and new demands do you see in your business – today and in future?

Dr. Matthias Lange: As a result of growing usage of carbon-fibre reinforced plastics in the aerospace industry the amount of Titanium tools will significantly grow – due to the good chemical and physical compatibility to carbon-fibre reinforced plastics. Because of relatively high material costs, raw parts are increasing being produced close to the final dimensional shapes. For machining tools, this means working at higher cutting speeds while cutting widths decrease in a so called semi-finished process. In this area new developments in coating technology are necessary for these kind of applications. Especially the machining and metalworking of Titanium alloyed integral components, like door frames of the airbus A350, will play an important role in future. This is a result of the considerably more difficult machinability required for longer running times, higher tool consumptions and tool costs compared to wrought Aluminium alloyed components.

LAYER: Dr. Lange, thank you very much. ■

Premium AEROTEC GmbH

The core business of Premium AEROTEC is Development and building of structures and manufacturing systems for civil and military aeroplanes. It is a worldwide leading company in its business.

Source: www.premium-aerotec.com

Setting Trends: State-of-the-Art Coating Equipment Technology

It is one thing to anticipate new developments in metalworking. But it is another thing to offer high-performance solutions and set trends in surface coating technologies.

Thanks to state-of-the-art equipment technology like METAPLAS-DOMINO customers of Sulzer Metco Thin Film are able to develop the right surface solutions for today and for upcoming machining trends.

“Besides short cycle times and increased productivity, flexibility is the key for the equipment technology in many ways”, Volker von der Heide, Segment Manager Thin Film Equipment at Sulzer

ing development are micro alloyed coatings (M•A•C), which are best tailored for machining and forming and provide excellent results, with enormous potential for the future.

technology also takes advantage of the extremely high ionisation of process gases provided by AEGD.

HIPAC – the foundation for the future

HIPAC technology is a further development of the only pulsed high-power impulse sputtering HIPIMS (High-Power Impulse Magnetron Sputtering) and perfectly appropriate to industrial and production related requirements. With HIPAC, the combination of HIPIMS and AEGD, high-power densities of 100 up to 1000W/cm² are set at the sputter target to allow the ionisation of the atoms.

To prevent target overloads high current impulses at low duty times of less than 10 percent are used. The ionisation of the metal in the plasma can nearly reach the same values as in ARC processes (10 up to 90 percent). With increasing current density at the target the layer density increases.

The properties of these deposited coatings are remarkable. Besides providing thin, dense and smooth coatings nearly no growth failures and droplets are realised. Additionally a decreased roughness



Modular and individual

“Due to the modular design the expansion possibilities are nearly unlimited. Starting with the basic solution the user is perfectly prepared for future developments and able to adapt to his individual needs for tomorrow”, von der Heide adds.

ARC and sputtering technologies, PACVD coating modules, combi treatment and the latest HIPAC (High Ionisation Plasma Assisted Coating) technology are all implemented in the equipment concept. Furthermore all METAPLAS-DOMINO systems are equipped with the patented highly efficient plasma cleaning process AEGD (ARC-Enhanced Glow Discharge). This additional fine-cleaning leads to unchallenged coating adhesion. The HIPAC

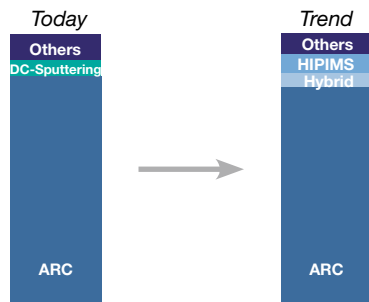
Metco Thin Film, says. The proven METAPLAS-DOMINO platform is the most important foundation for this. The technical features of the system (see table) allow producing an enormous number of individually tailored coatings fast, reliably and fully automatic on metal, ceramic and plastic surfaces for different applications. A milestone in coat-

Technical Features of the PVD Equipment Concept

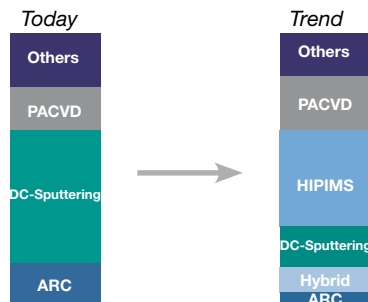
	DOMINO mini	DOMINO S	DOMINO L
Usable Coating Volume:	Ø 300 mm x 300 mm	Ø 400 mm x 500 mm	Ø 600 mm x 700 mm
APA-ARC Evaporators:	2 to 6	3 to 12	4 to 16
Magnetron Sputter Sources:	1 to 3	1 to 4	1 to 4
Plasma Cleaning:	All systems equipped with patented Power Etching Process AEGD		
Substrate Table:	5 shafts	6 shafts	9 shafts
Loading Capacity for End Mill Ø 10 x 70:	240 pieces	480 pieces	900 pieces
Target Costs per Tool for Ø 10 x 70 for Mtec:	0.07 – 0.08 euro per tool	0.05 – 0.06 euro per tool	0.04 – 0.05 euro per tool

The high performance METAPLAS-DOMINO system for high productivity even for low volume use

1) Machining tools



2) Components, Functional parts



Groups of PVD coating processes – world wide share of the total volume related to machining tools and components as well as functional parts today and expected in future

compared to ARC technology is achievable.

HIPAC offers a huge potential for deposition of morphological dense coatings at low substrate temperatures. New opportunities are opened up for the coating of components, wear parts and also functional parts made of different plastics. In this area DC sputtering, also in combination with PACVD is well presented. Already today everything points to partial substitution of sputter technique due to HIPIMS, as well as hybrid techniques.

Trend-setter hybrid-technology

The modular equipment system allows the combination of different modules and technologies to hybrid processes. The availability of two high-ionisation processes, HIPAC and APA-ARC, obviously leads to the logical combination of both processes to a hybrid process which meet industrial standards. Hybrid technology is one of the most innovative approaches in surface technology. For those being real experts in both technological areas completely new opportunities open up. Process and material combinations can be realised for developing innovative high-performance coatings to

be used in e.g. machining and forming applications. This market segment will be dominated by the constant developing ARC technology also in future. In the area of high-end applications the importance of hybrid technique will keep growing incrementally. Furthermore the trend shows that HIPIMS will replace the yet not well represented DC sputtering in machining industry. The limits of PVD technology are expanded by new complementary technologies like HIPAC. The HIPAC process provides materials for creating new coatings that can not be deposited using ARC processes like e.g. TiB₂, Si. Layer compositions can be tailored to the relevant applications by

- micro-alloying,
- doping,
- layer design and
- layer architectures.

“With a hybrid system our customers and our coating services are not only able to follow coating trends but also to set trends” von der Heide summarises. Thanks to latest developments the equipment concept is prepared for future demands and applications. ■



Presentation of an ARC coating process



Presentation of a HIPIMS coating process

Diverse technology modules offer a lot of possibilities with the technology platform METAPLAS-DOMINO

APA-ARC Modules Advanced Plasma Assisted evaporation technology
Sputtering Modules DC, DC pulsed, RF; MF; HIPIMS
HIPAC Module High Ionisation Plasma Assisted Coating
DLC Modules PACVD, Magnetron Sputtering + PACVD
Combi Module Combination of Nitriding and PVD/PACVD

- Diverse combinations
- Later expansions possible
- Patented processes and coatings
- Production and R&D support

Contact person:
Volker von der Heide
Head of Systems Sales
Tel.: +49 2204 299 258
e-mail: volker.vdheide@sulzer.com

“Optimal for Our Research Purposes”

The Japanese research institute TIRI relies on the DOMINO *mini* Thin Film equipment



Dr. Georg Erkens in discussion with Dr. Masahiro Kawaguchi

Dr. Masahiro Kawaguchi (Visiting Associate Professor of Shibaura Institute of Technology) as representative of the Tokyo Metropolitan Industrial Technical Research Institute (TIRI) visited Bergisch Gladbach for system acceptance. LAYER talked with him at this occasion about the decision for the DOMINO *mini* and about the cooperation with Sulzer Metco Thin Film in general.

“... the high level of technical know-how regarding the system as well as the application expertise...”

LAYER: Dr. Kawaguchi, how did you experience the close and direct cooperation with the colleagues from Sulzer Metco Thin Film?

Dr. Masahiro Kawaguchi: In particular

the high level of technical expertise about the system and the application know-how are an important support for me now and also in future. The employees from the R&D department dedicated much time for me, which is very important for this new and demanding technology. Additionally, I have learned a lot of interesting and amusing things about the country and people.

LAYER: Which role will the Thin Film equipment play in everyday use at your institute?

Dr. Masahiro Kawaguchi: At work I primarily focus on modification and optimi-



Detailed instruction: Dr. Masahiro Kawaguchi and Dr. Jürgen Müller

sation of surfaces. This mainly includes carbon coatings. The DOMINO *mini* plays a key role in our service portfolio because it offers state-of-the-art technology, like HIPAC. This system is the first PVD equipment that is used for research and development purposes providing HIPAC in Japan. We are therefore very proud of setting up this optimal solution tailored to our needs.

LAYER: Regarding the coatings: Which properties are you going to study with this system primarily?

Dr. Masahiro Kawaguchi: Interesting in order to use carbon is especially the combination of a low coefficient of friction at very high hardness, corrosion protection or thermal conductivity – made

possible with HIPAC technology. Transferred to the practice a lot of potential for versatile applications is offered. An additional distinct advantage of HIPAC is the clearly higher ionisation of the tar-

get material (up to 90 percent) compared to DC sputtering (up to 20 percent).

LAYER: Dr. Kawaguchi, thank you very much for the interview. ■

Contact persons:

Dr. Jürgen Müller
R&D Manager
PVD Systems & Application
Tel.: +49 2204 299 280
e-mail: juergen.mueller_dr@sulzer.com

Dr. Georg Erkens
Division Manager Systems, R&D
Tel.: +49 2204 299 354
e-mail: georg.erkens@sulzer.com

TIRI – “Growing with its Customers”

While big companies and groups can count on the innovative strength of their R&D employees small and medium-sized enterprises (SME) lack adequate resources to maintain such a department. Also with topics like product development or promotion questions these companies often have competitive disadvantages.

TIRI was originated in 2006 to help SMEs from all industries – with analyses, technological capacities and competent consulting. A key focus is on unbureaucratic, flexible and quick help.

In the metropolitan area of Tokyo 70,000 to 80,000 small and medium-sized enterprises are located which can count on the support of TIRI.

Internet: www.iri-tokyo.jp/english/index.html



Andrea Hürlimann, Head of Market Segments

On Innovation Drivers and Expansion Plans

Andrea Hürlimann, Head of Market Segments at Sulzer Metco Thin Film, speaks about the presence at the EMO, state-of-the-art developments and the high service standards of the company.

Trends and latest developments are presented at the EMO – the exhibition is the summit for the metalworking industry. Sulzer Metco Thin Film focuses on state-of-the-art solutions in PVD coating, especially for micro alloyed coatings. These coatings gain in importance besides all-round coatings like AlTiN-Saturn. The main focus is on Mpower for hard and Titanium machining as well as on Ffusion for Aluminium die casting. Thin Film equipment is going to play an important role at the trade fair booth as Andrea Hürlimann announces: “The hybrid technology, our latest development, combines the benefits of two high ionisation coating processes. This opens up completely new design and application opportunities for PVD surfaces. Our modular Thin Film equipment METAPLAS-DOMINO is the platform for these innovative technologies.” The small sister will be presented on the exhibition.

“We offer our services where they are needed by our customers”

Professional and geographically nearby

EMO is a catalyst for developments in the metalworking industry as this branch is an important driver of innovation for the coating technology. “The close contacts to the users and the continuous feedback from practical work help us to steadily develop coatings for machining and forming, as well as other industries”, Hürlimann emphasises the importance of a close relationship and adds:

“A special opportunity to provide optimal service to our customers is a Shop-in-Shop solution. We offer turnkey

solutions which can go into production fast and in an uncomplicated manner.” Thanks to the full integration in the customer’s production line and logistics our coating competence is directly on site – for short reaction times, even if process requirements change. This saves costs and increases flexibility.

New equipment in Altbach and America

The launch of the PVD coating service in the USA is planned for 2012. With its METAPLAS-DOMINO technology Sulzer Metco Thin Film can offer coating services for all known coatings in the USA. Additionally the company will also be expanding its capacities in Germany explains Hürlimann: “In general we offer our services where they are needed by our customers – this is true for all four technologies: PVD, DLC coating, plasma heat treatment and combi treatment. For example, due to high demand we increased our capacities in Altbach and put a second METAPLAS-DOMINO system in operation with the option to further increase our capacities if necessary.” ■

Visit Us!



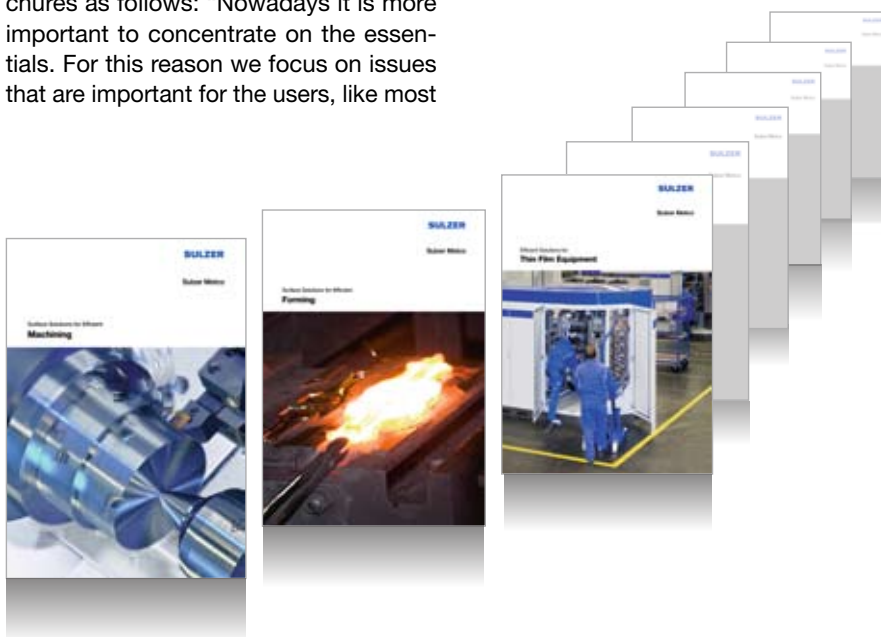
Hall 5,
Booth B33

New Brochures

Presented clearly and informative – this is how our new brochures for the plastics, machining, forming, semiconductor, racing, automotive, Thin Film equipment and engineering industries are.

On at least six pages the respective processes and coatings including their properties are presented to customers and interested parties. Corinna Heinz, Marketing Manager at Sulzer Metaplas, describes the function of the new brochures as follows: “Nowadays it is more important to concentrate on the essentials. For this reason we focus on issues that are important for the users, like most

important benefits, applications and technical data of the coatings. This way they get a faster overview of the possibilities and benefits for the respective industries.” ■



Donation for Kids

Big enthusiasm for childrens' forklift trucks

The girls and boys of the day care centre “Bunte Kinderwelt” in Chemnitz were truly surprised: Right for Easter celebration Sulzer Metco Thin Film presented two childrens' forklift trucks to the site in Niederwürschnitz. These have been quickly absorbed – no matter boy or girl. Everyone wanted to be No.1 playing with the new toys. The supervisors of the children shared the enthusiasm of the children as well. Bernhard Reiser, Site Manager Niederwürschnitz: “We have got the small forklift trucks from one of our suppliers. But who has better use for this than a day care centre?” A big “Thank You” came on return from the kids. They



“Not only my dad can operate a forklift truck.”

built a collage showing the forklift trucks in action and have sent it together with a thank you letter to the site in Niederwürschnitz. ■

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, Germany
19–24 September 2011

Härtereikolloquium

Wiesbaden, Germany
12–14 October 2011



FAKUMA

Friedrichshafen, Germany
18–22 October 2011



Professional MotorSport WORLD EXPO 2011

Cologne, Germany
15–17 November 2011

PLAST

Milan, Italy
8–12 May 2012

Contact person:

Corinna Heinz
Marketing Manager
Tel.: +49 2204 299 215
e-mail: corinna.heinz@sulzer.com

Up-to-date

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

thinfilm.sulzermetco.com

Sulzer Metaplas GmbH
Germany
Headquarters
Am Böttcherberg 30–38
51427 Bergisch Gladbach
Tel.: +49 2204 299-0
Fax: +49 2204 299-266
e-mail: metaplas@sulzer.com

Sulzer Metaplas GmbH
Germany
Theodor-Heuss-Straße 63
38228 Salzgitter
Tel.: +49 5341 8587-0
Fax: +49 5341 8587-16
e-mail: thinfilm.salzgitter@sulzer.com

Sulzer Metaplas GmbH
Germany
Bernd-Beltrame-Straße 5
09399 Niederwürschnitz
Tel.: +49 37296 9324-0
Fax: +49 37296 9324-119
e-mail: thinfilm.niederwuerschnitz@sulzer.com

Sulzer Metaplas GmbH
Germany
Oststrasse 68
32051 Herford
Tel.: +49 5221 6933-30
Fax: +49 5221 6933-25
e-mail: thinfilm.herford@sulzer.com

Sulzer Metaplas GmbH
Germany
Im Ghai 20
73776 Altbach
Tel.: +49 7153 613117-0
Fax: +49 7153 613117-9
e-mail: thinfilm.altbach@sulzer.com

Sulzer Sorevi S.A.S.
France
125 Rue des fougères
74890 Bons-en-Chablais
Tel.: +33 4 50 31 40 06
Fax: +33 4 50 31 75 34
e-mail: thinfilm.bonsenchablais@sulzer.com

Sulzer Sorevi S.A.S.
France
5 Allée Skylab – Parc d’Ester
BP 6810
87068 Limoges Cedex
Tel.: +33 5 55 37 04 90
Fax: +33 5 55 38 13 35
e-mail: thinfilm.limoges@sulzer.com

Sulzer Metco (US) Inc.
USA
6000 North Bailey Avenue, Suite 9
Amherst, NY 14226
Tel.: +1 716 270 2228
Fax: +1 716 270 2230
e-mail: thinfilm.amherst@sulzer.com

Sulzer Metco (US) Inc.
USA
12 T.W. Alexander Dr., Bldg. 200 Suite B
Research Triangle Park, NC 27709
Tel.: +1 919 485 6001
Fax: +1 919 485 8995
e-mail: thinfilm.rtp@sulzer.com

**Sulzer Metco
Surface Technology (Shanghai) Co. Ltd.**
P.R. China
666 Min Bei Road
Minhang, Shanghai 201107
Tel.: +86 21 5226 2000
Fax: +86 21 5226 4701
e-mail: smcn.shanghai@sulzer.com

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Sulzer Metaplas GmbH
Am Böttcherberg 30–38, 51427 Bergisch Gladbach
www.sulzermetco.com

Editorial Staff:
Sulzer Metaplas GmbH
Corinna Heinz, Andrea Hürlimann
C&G: Strategische Kommunikation GmbH, Overath

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C&G: Strategische Kommunikation GmbH, Overath
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