

VOLKSWAGEN

AKTIENGESELLSCHAFT



Fraunhofer

IKTS



SMART MATERIAL

SEPTEMBER 22-23, 2011, DRESDEN

INTERNATIONAL SYMPOSIUM ON PIEZOCOMPOSITE APPLICATIONS

PROGRAM



INTERNATIONAL SYMPOSIUM ON
PIEZOCOMPOSITE APPLICATIONS

VOLKSWAGEN'S "DIE GLÄSERNE MANU-
FAKTUR", DRESDEN, GERMANY

SEPTEMBER 22-23, 2011

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WELCOME TO ISPA 2011

Dear Colleague,

It is a great pleasure to invite you to attend the International Symposium on Piezocomposite Applications – ISPA 2011 to be held in the industrial, scientific and cultural center, the city of Dresden (Germany) from September 22 to 23, 2011.

The conference is organized by Fraunhofer IKTS, Volkswagen and Smart Material and takes place within the Transparent Factory of Volkswagen in visual contact with the final assembly of luxury sedans.

Piezocomposites combine the functionality of piezoceramics as electromechanical transducer material for sensing, actuation, charge generation and charge storage with the robustness and mechanical stability of a complimentary structural material. Increasingly, electronic circuits are integrated improving the system performance tremendously. Today many different types of piezocomposite transducers are available. They are based on polymer, ceramic or light metal matrix architectures or built on silicon wafers.

Numerous research projects during the past years have proven the concept of using piezocomposite devices in vibration and

WELCOME TO ISPA 2011

noise control applications, as well as for health monitoring, morphing of structures and energy harvesting. The migration from research projects to high volume, cost effective commercial applications has generated the need for new system components and system design tools. This includes optimized electronic components and modeling tools.

In view of a comprehensive and proper exploitation of piezocomposites, in the different fields of application, the symposium aims to represent a forum for exchanging ideas, presenting the latest developments and trends, proposing new solutions and promoting international collaborations.

Original papers representing the state-of-the-art, open discussions during the workshop, poster session and product display will give engineers, designers and researchers the opportunity to exchange ideas and contact other interested partners for the collaboration of new marketable products.

Together with the members of the scientific and organizing committees, I look forward to meeting you in Dresden.

Yours, Andreas Schönecker

A handwritten signature in black ink, reading "Andreas Schönecker". The signature is written in a cursive style with a large initial 'A'.

PROGRAM



PROGRAM

THURSDAY, SEPTEMBER 22, 2011

8:30 Opening

- 8:30 **Prof. Dr. Jürgen Leohold**
Executive director group research
Volkswagen AG, Wolfsburg, Germany
- 8:40 **Prof. Dr. Alexander Michaelis**
Institute director
Fraunhofer IKTS, Dresden, Germany
- 8:50 **Peter G. Nothnagel**
Managing director
Saxon Economic Development Corporation,
Dresden, Germany

9:00 Keynotes

- 9:00 **Mass market application for piezocomposites – haptics**
Christophe Ramstein (Immersion Corporation,
San Jose/CA, USA)
- 9:30 **Materials and processes for aerospace applications**
Robert G. Bryant (NASA Langley Research
Center, Hampton/VA, USA)
- 10:00 **Novel micro injection moulding technology for a high volume production of piezoactive modules**
Michael Heinrich (Chemnitz University of Technology, Germany)



10:30 Coffee break in exhibition area

11:10 Session 1: Piezoelectric materials and devices I

- 11:10** Recent developments of actuators
Hans-Jürgen Schreiner (CeramTec GmbH, Lauf, Germany)
- 11:30** Physical properties of
 $\text{BaTiO}_3\text{-A}(\text{Cu}_{1/3}\text{Nb}_{2/3})\text{O}_3$ (A=Ba,Sr,Ca) system grown by aerosol deposition method
Jong-Woo Kim (Korea Institute of Materials Science (KIMS), Gyeongnam, Korea)
- 11:50** Integrated piezoelectrics based on PZT thick films: advantages and limitations
Sylvia Gebhardt (Fraunhofer IKTS, Dresden, Germany)
- 12:10** Electroactive nanotube polymer nanocomposites for sensors and actuators
Cheol Park (National Institute of Aerospace (NIA), Hampton/VA, USA)
- 12.30** Preparation and characterization of acoustic transducers based on KNN
Andreas Schönecker (Fraunhofer IKTS, Dresden, Germany)

12:50 Lunch break in exhibition area

PROGRAM

THURSDAY, SEPTEMBER 22, 2011

- 14:30 Session 2: Piezoelectric materials and devices II**
- 14:30 Wide-band air-coupled ultrasonic piezoelectric transducers**
Tomas E. Gómez Álvarez-Arenas (Spanish National Research Council CSIC, Madrid, Spain)
- 14:50 Recent progress in 1-3 piezocomposites for underwater applications**
Richard Meyer (Penn State University, University Park/PA, USA)
- 15:10 Single crystal 1-3 piezocomposites for high performance transducers**
Christine Démoré (University of Dundee, UK)
- 15:30 Triangular piezocomposite transducers for point load actuation**
Sudharsana Raamanujan Raman (Université Libre de Bruxelles, Belgium)
- 15:50 Temperature-dependent blocking force measurements of lead-free $0.94\text{Bi}_{1/2}\text{Na}_{1/2}\text{TiO}_3$ - 0.06BaTiO_3 in comparison with soft-doped PZT**
Robert Dittmer (Technische Universität Darmstadt, Germany)
- 16:10 Fatigue in lead-free $(1-x)\text{Bi}_{1/2}\text{Na}_{1/2}\text{TiO}_3$ - $x\text{BaTiO}_3$ bulk ceramics and multilayer**
Eva Sapper (Technische Universität Darmstadt, Germany)



16:30 **Guided tours**

16:30 Volkswagen's "Die Gläserne Manufaktur"
(The Transparent Factory)

17:00 Fraunhofer IKTS lab tour
(16:30-17:00 organized transfer to Fraunhofer
Institute Center Dresden, Winterbergstrasse 28)

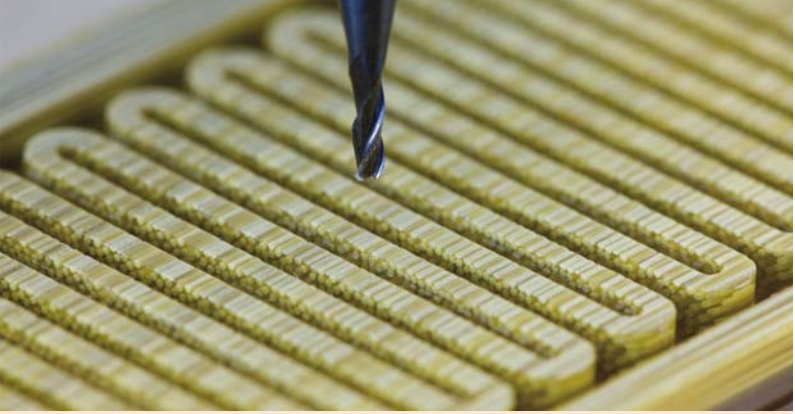
19:00 **Dinner at Café Central**

Organized transfer to Café Central in the city center of
Dresden (Altmarkt 6)

PROGRAM

FRIDAY, SEPTEMBER 23, 2011

- 8:30** **Session 3: Actuation and sensing, vibration damping, industrial application**
- 8:30** **Particle manipulation in polymeric lab-on-chip resonators: influence of the piezoelectric actuator**
Itziar Gonzalez (Spanish National Research Council CSIC, Madrid, Spain)
- 8:50** **Monitoring of a composite plate using integrated vibration measurement system**
Angelos Filippatos (Technische Universität Dresden, Germany)
- 9:10** **Correcting thermal deformations in a meter-scale reflector system using piezo-composite actuators**
Samuel Case Bradford (Jet Propulsion Laboratory, Pasadena/CA, USA)
- 9:30** **Piezo-based parallel kinematics for tool positioning**
Markus Ullrich (Fraunhofer IWU, Dresden, Germany)
- 9:50** **Developments at ULB in the field of smart structure applications**
André Preumont (Université Libre de Bruxelles, Belgium)
- 10:10** **Coffee break in exhibition area**



11:00 **Session 4: Structural health monitoring, energy harvesting, electronics**

- 11:00 **Piezocomposite transducers for structural health monitoring in aerospace structures**
Peter Wierach (German Aerospace Center (DLR), Braunschweig, Germany)
- 11:20 **Piezoelectric generator module for wireless sensor nodes in aerospace structures**
Thomas Rödiger (Fraunhofer IKTS, Dresden, Germany)
- 11:40 **Reduce cost of ownership in wireless sensors using energy harvesting and IPS' THINERGY® MECs – a novel approach to dynamically adjust energy balance**
Richard Percival (Infinite Power Solutions, Inc., Littleton/CO, USA)

12:00 **Session 5: Modeling, characterization, reliability**

- 12:00 **Inertial-and-load dependent Prandtl-Ishilinskii model**
Tegoeh Tjahjowidodo (Nanyang Technological University, Singapore)
- 12:20 **Reliable modeling of piezoelectric sensor and actuator devices**
Stefan J. Rupitsch (Friedrich-Alexander University Erlangen-Nuremberg, Germany)

PROGRAM

FRIDAY, SEPTEMBER 23, 2011

- 12:40 Numerical analysis of process induced residual stresses in thermoplastic compatible piezoceramic modules
Thomas Heber (Technische Universität Dresden, Germany)
- 13:00 Lunch break in exhibition area
- 15:00 Session 6: Systems integration, future developments
- 15:00 Integration of electronic components in glass fibre-reinforced polyurethane composite structures
Sirko Geller (Technische Universität Dresden, Germany)
- 15:20 Piezocomposite applications in automotive industry – challenges and requirements
Knut Schmidt (Volkswagen AG, Wolfsburg, Germany)
- 15:40 Piezocomposites – new applications and products on the radar?
Thomas Daue (Smart Material Corp., Sarasota/FL, USA)
- 16:00 Coffee and farewell in exhibition area



Fraunhofer
IKTS

FRAUNHOFER IKTS

The Fraunhofer Institute for Ceramic Technologies and Systems IKTS develops state-of-the-art, application-oriented, high-performance ceramic materials; industrial preparation processes using powder technology, wet chemistry, and precursors; and prototype components and systems. With applied fundamental research as our basis and within the framework of R&D projects with partners, we develop concepts for product and process innovations in numerous trendsetting industry sectors, including energy and environmental technology, mechanical and plant engineering, microsystems and medical technology, and vehicle manufacturing. Closed technology chains extending from starting material to prototype on an industrially oriented pilot scale and accompanied by state-of-the-art process and product analysis represent an outstanding capability of our institute.

Our research fields:

- Materials
- Processes and Components
- Sintering and Characterization
- Environmental Engineering and Bioenergy
- Microsystems and Energy Systems
- Smart Materials and Systems

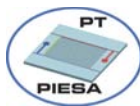
Fraunhofer IKTS is one of 60 institutes of the Fraunhofer-Gesellschaft in Germany.

ANNOUNCEMENT

RELATED WORKSHOP

An open workshop on advanced materials will take place on September 21, 2011 at Fraunhofer IKTS, right before the ISPA 2011.

This event is supported by the Collaborative Research Center/Transregio 39 "PT-PIESA" and is open to the public.



Date

Wednesday, September 21, 2011 from 3 p.m. until 6 p.m.

Location

Fraunhofer IKTS, Winterbergstrasse 28, 01277 Dresden
Room "Meissen"

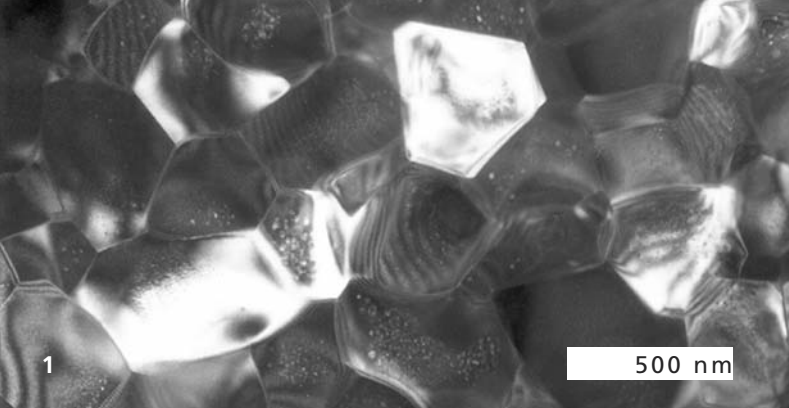
Registration

Registration is not necessary.

To make sure that you get a place, please send an email with your name to ispa2011@ikts.fraunhofer.de.

Fees

The workshop is free. There are no entry fees.



Presentations

- 15:00 **Development and characterization of Boron Nitride Nanotubes (BNNTs)**
Cheol Park (NASA - LARC, National Institute of Aerospace, USA)
- 15.30 **Manufacturing and applications of vertical aligned Carbon Nanotubes (va-CNT)**
Ingolf Endler et al (Fraunhofer IKTS, Dresden, Germany)
- 16:00 **Cutting-edge transmission electron microscopy: gaining nanoscale Insights into glasses and ceramics**
Thomas Höche et al (Fraunhofer IWM, Halle, Germany)
- 16:30 **Lab tour**
We offer to the participants the opportunity to join a lab tour through Fraunhofer IKTS after the talks.

1 SPS processed $Ba_2TiSi_2O_8$ ceramics (source: Fraunhofer IWM).



LOCATION

Conference venue

For the third time Volkswagen's "Die Gläserne Manufaktur" (The Transparent Factory) is the exceptional setting for the conference series ISPA – International Symposium on Piezocomposite Applications. At the Strassburger court, in the city center of Dresden, the Transparent Factory rises with its 40 meter high glass tower. On an area of 55,000 square meters the production area of the VW Phaeton is presented to the visitors. It is unique that every individual working step on the vehicle can be observed.

The organizers are very pleased to present this unique and exclusive environment again as venue of the ISPA.

City of Dresden

Spirited intellectual exchange is a tradition in this internationally known artistic and cultural metropolis. Scientific competency and inventiveness have enabled the city to assert itself again and again as a high-tech location.

Since as early as the 18th century, Dresden has been shaped by a fruitful association of business and science. Important inventions and developments resulted from this symbiosis.



In 1708 Johann Friedrich Böttger developed the technique for making European porcelain here. Andreas Schubert, engineer and university professor, designed Germany's first steam engine for the original Saxon paddle steamers which are still a great attraction on the river Elbe today. It was Dresden camera experts who developed the reflex camera, the panoramic camera and the stereo camera. Heinrich Georg Barkhausen was a German physicist who discovered the Barkhausen effect, a principle concerning changes in the magnetic properties of metal. He also worked as a professor at the Dresden University of Technology, which was founded in 1828 as the "Technische Bildungsanstalt Dresden" and is thus one of Germany's oldest technical colleges.

Today, the Dresden region has the strongest engineering and natural sciences research and development sector in Eastern Germany. Research covers a wide range of areas from basic and applied research in future technologies (information and communications technology, new materials, material and components surface treatment and biotechnology) to industrial research in almost all the industrial sectors which are represented in Dresden.

Besides, the Saxon residence presents itself as a modern city, although even today the buildings from the renaissance, baroque and 19th century, like the Zwinger, the Semper Opera House, the Royal Palace or the Frauenkirche, determine the Elbe front and the face of the city.

www.cmcee12.de

10th **CMC***ee*

**International Symposium on Ceramic
Materials and Components for Energy
and Environmental Applications**

May 20-23, 2012

Dresden, Germany
International Congress Center



For more information see
www.cmcee12.de

Save the date!

CMC*ee*

Hosted
by



Fraunhofer
IKTS



EXHIBITORS





Microfine Materials Technologies Pte Ltd (in collaboration with Cytoscience SA and Philipps University Marburg)

10 Bukit Batok Crescent,
The Spire # 06-02,
Singapore 658079

www.microfine-piezo.com

Contact

Dr. Leong-Chew Lim
Phone +65 9617 2157
liclim@microfine-piezo.com

Areas of expertise

- Growing of PZN-PT piezo single-crystals
- Development and manufacturing of piezoelectric devices
- Advanced single crystal underwater transducers
- Ultra-high sensitivity accelerometers

Exhibited items

- Ultra-high sensitivity seismic/infra-sonic accelerometers

PI Ceramic GmbH

Lindenstrasse
07589 Lederhose, Germany

www.piceramic.de

Contact

Frank Möller
Phone +49 36604 882-0
info@piceramic.de

Areas of expertise

- Smart materials
- Piezoelectric components
- DuraAct (TM) patches
- Piezoceramic actuators

Exhibited items

- DuraAct (TM) patch transducer
- Piezoceramic actuators
- Piezoceramic components



aixACCT Systems GmbH

Talbotstrasse 25
52068 Aachen, Germany

www.aixacct.de

Contact

Dr. Stephan Tiedke
Phone +49 241 47570-30
tiedke@aixacct.com

Areas of expertise

- Piezoelectric actuator testing
- Piezoelectric thin film qualification
- Piezoelectric bulk ceramic characterization
- High voltage amplifiers with high bandwidth

Exhibited items

- Piezoelectric evaluation system (aixPES)

Fraunhofer Institute for Ceramic Technologies and Systems IKTS

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01277 Dresden, Germany

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Contact

Dr. Andreas Schönecker
Phone +49 351 2553-7508
andreas.schoenecker@ikts.fraunhofer.de

Areas of expertise

- Electroceramic materials
- Smart structure applications
- Microsystems technology

Exhibited items

- Integrated actuators for smart structure applications
- Demonstration: piezoelectric and acoustic sensing, energy harvesting and vibration damping

EXHIBITORS

Smart Material GmbH

Löbtauer Strasse 69
01159 Dresden, Germany

www.smart-material.com

Contact

Dr.-Ing. Jan Kunzmann
Phone +49 351 4977-145
j.kunzmann@smart-material.com

Areas of expertise

- Piezofiber composites
- Actuators
- Sensors
- Energy harvesting
- Ultrasonic transducers

Exhibited items

- MFC – Macro Fiber Composites
- 1-3 Piezofiber composites
- Energy harvesting development kit
- High voltage amplifiers
- Strain measurement demonstrator

CeramTec AG

Luitpoldstrasse 12
91207 Lauf, Germany

www.ceramtec.com

Contact

Dr. Alfons Kelnberger
Phone +49 9123 77-268
a.kelnberger@ceramtec.de

Areas of expertise

- High performance ceramics, multi-functional ceramics
- Piezo ceramics, PZT multilayer stack actuators and benders for dynamic and static applications
- Silicate ceramics
- Metallized ceramics



Fraunhofer Institute for Machine Tools and Forming Technology IWU

Nöthnitzer Strasse 44
01187 Dresden, Germany

www.iwu.fraunhofer.de

Contact

Tom Junker
Phone +49 351 4772-2435
tom.junker@iwu.fraunhofer.de

Areas of expertise

- Adaptronics, mechatronics, composite design, metal foam, material science

Exhibited items

- Functionally integrated shape memory actuator
- Functionally integrated piezoelectric actuator
- Metal foam

Immersion Corporation

801 Fox Lane
San Jose, California 95131, USA

www.immersion.com

Contact

Ali Modarres
Phone +1 514 987-9800
amodarres@immersion.com

Areas of expertise

- Haptics: mobile handsets, touch-screen, robotic arm, SDK, etc.
- Haptic system integration

Exhibited items

- TS 3000/TS 5000 Handheld demo
- HD Haptics R1 demo
- Haptics Automotive A100/A300/A1EVO demos
- Inertial piezo GC3 demo

EXHIBITORS

TU Dresden, Institute of Lightweight Engineering and Polymer Technology (ILK)

Holbeinstrasse 3
01307 Dresden, Germany

tu-dresden.de/mw/ilk

Contact

Dipl.-Ing. Thomas Heber
Phone +49 351 463-38594
t.heber@ilk.mw.tu-dresden.de

Areas of expertise

- Lightweight engineering
- Polymer technology
- Composites
- Multi-material design
- Function integration

Exhibited items

- Thermoplastic-compatible piezo-ceramic modules (TPM)
- Function-integrative composite structures

TU Dresden, Institute of Material Science (IfWW)

Winterbergstrasse 28
01277 Dresden, Germany

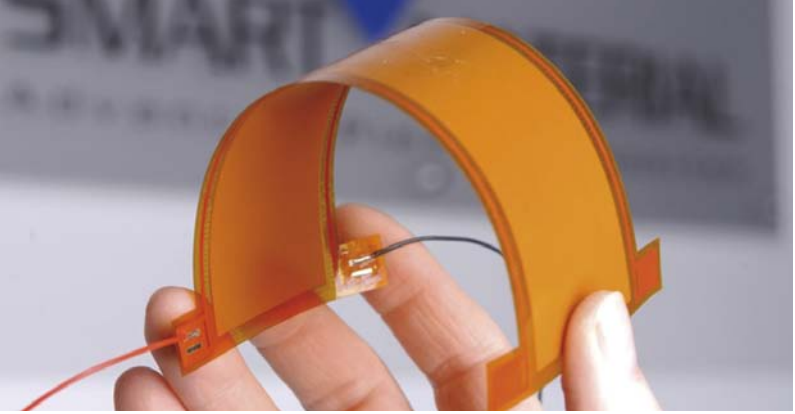
tu-dresden.de/mw/ifww

Contact

Prof. Alexander Michaelis
Phone +49 351 2553-7512
alexander.michaelis@ikts.fraunhofer.de

Areas of expertise

- Ceramic structural materials
- Ceramic functional materials
- Integrable piezoelectric fibers and laminates
- Combinatory microelectrochemistry
- Instrumented compaction of powders and granules



Smart Material Corporation and its affiliated company Smart Material GmbH are specialized in the production and development of innovative piezocomposite components: 1-3 Fiber Composites and the Macro Fiber Composites. With the unique Macro Fiber Composites (MFC) technology, licensed by NASA, Smart Material possesses a pioneering actuator technology that has already proved its suitability and versatility for numerous applications, ranging from aerospace use, vibration and noise damping to shape-changing structures, from strain gauge applications to dynamic structural health monitoring and energy harvesting. Comprised of piezo-ceramic fibers, the 1-3 Random Fiber Composites provide an outstanding performance for ultrasonic transducers in the frequency range of 50 kHz-12 MHz. The leading applications are non-destructive testing, medical- and sonar applications.

Our mission: to provide advanced piezo composites for commercial applications in high quantity, high quality and low cost.



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01159 Dresden, Germany
Phone +49 351 4977-145
Fax +49 351 4977-146
dresden@smart-material.com

REGISTRATION FEES

Regular	Euro 350
Reduced*	Euro 200
Exhibitors	Euro 500

The registration fee includes coffee, two lunches, the conference dinner and the conference documents.

Registration will be possible with the registration form on our website www.ikts.fraunhofer.de. Please use one form for each participant. In case of cancellation until September 15, 2011, the total fee will be refunded. After this date, a refund of the registration fee minus an administration fee of 100 euros is possible.

** Only students with valid student card and exhibitor second persons qualify for the reduced fee.*

HOTELS

Fraunhofer IKTS holds a block of rooms in different hotels. Room reservations should be made directly. If you make your reservation, please give the corresponding keyword in order to receive the special hotel rate.

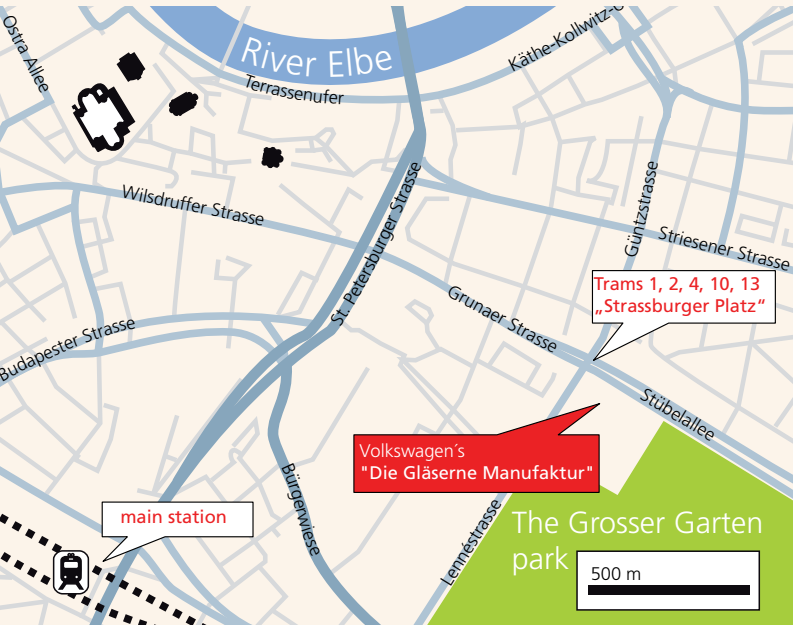
Please visit our website for updated and more detailed information www.ikts.fraunhofer.de.

MAP

A4 to Chemnitz

A13 to Berlin

A14 to Leipzig



A17 to Prague

Volkswagen's "Die Gläserne Manufaktur" (The Transparent Factory)

Automobilmanufaktur Dresden GmbH

Lennéstrasse 1

01069 Dresden, Germany

www.glaeserne-manufaktur.de

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CONFERENCE VENUE

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