The 27th International Conference on Electrical Contacts

ICEC 2014 Dresden, Germany



Program

June 22 - 26, 2014

International Congress Center Dresden (ICD) & MARITIM Hotel

www.icec2014.org







The 27th International Conference on Electrical Contacts will be held from June 22 - 26, 2014 at the International Congress Center Dresden, Germany.

The first ICEC was organized by Dr. Ragnar Holm and Prof. R. E. Armington and held at the University of Maine in 1961. Since then, ICEC has been held in Germany three times (Munich, Berlin, Nuremberg).

The purpose of the ICEC 2014 in Dresden is to provide a forum for the presentation and discussion of the latest research and development in the field of electrical contacts and other related fields all while promoting an exchange of scientific and technical knowledge between specialists from all over the world.

Throughout its history, the ICEC has greatly contributed to the development of this field and to the promotion of international collaboration.



Sincerely yours

Univ.-Prof. Dr.-Ing. Frank Berger TU Ilmenau, Germany

Welcome to the City of Dresden

On behalf of the city of Dresden, I congratulate you on your decision to carry out the 27th International Conference on Electrical Contacts (ICEC) in our beautiful city. You will notice – Dresden has a lot to offer. It is one of the leading business locations in Germany and has excellent prospects for further growth – a success which is based on courageous lighthouse policy. We have invested in high technology and in the research associated with it. And it has paid off.

Dresden is a top location in the key sectors of microelectronics, nanotechnology, new materials and life sciences. The world's leading enterprises such as GlobalFoundries, Glaxo SmithKline Biologicals, OF ARDENNE or Novaled operate in Dresden. Many companies from various industries are deeply rooted in the city. They take advantage of a cooperative local research milieu with excellent institution from Max-Planck, Helmholtz, Leibniz or Fraunhofer Society. The diversity of industries is a major reason for the sustained positive development of the economy of Dresden.

Not least impressive "Elbflorenz" with its unique quality of life: the Frauenkirche, the Semper Opera House, the Green Vault, the trendy district of New Town, the picturesque Elbe Valley – in Dresden, it is easy to keep the balance between work and leisure.

We are delighted that your international conference, combines culture and economy and connects your and our success story. We wish you a pleasant stay and useful new contacts.



Deputy Mayor, Head of Department of Economic Affairs

Organized by

VDE, Association for Electrical, Electronic & Information Technologies

ETG, the Power Engineering Society whithin VDE

ITG, Information Technology Society within VDE

Organizing Committee

| Chairman | F. Berger (TU Ilmenau) | |
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ICEC 2014 - Program Overview

| Time | Plenary | Exhibition |
|----------------|--------------------------------|---------------------|
| | | |
| Sunday, June 2 | 22, 2014 | |
| 17:00 - 19:00 | Registration | Set up Exhibition |
| Monday, June | 23, 2014 | |
| 8:00 | Registration | |
| 10:00 | Opening Session | |
| 10:30 | 01. Fundamentals | |
| 12:30 | | Lunch |
| 13:30 | 02. Materials I | |
| 15:30 | | Coffee Break |
| 16:00 | 03. Connectors | |
| 18:00 | | Get Together – |
| | | Poster Session with |
| | | Buffet |
| Tuesday, June | 24, 2014 | |
| 7:30 | Registration | |
| 8:00 | 04. Arc Interuption/DC | |
| 10:00 | | Coffee Break |
| 10:30 | 05. Contacts/Connectors | |
| 12:30 | | Lunch |
| 13:30 | 06. Materials II/Vacuum | |
| | and Refractory Contacts | |
| 15:30 | | Coffee Break |
| 16:00 | Albert-Keil-Ceremony | |
| 17:00-19:00 | | Poster Session |
| Wednesday, Ju | ine 25, 2014 | |
| 7:30 | Registration | |
| 8:00 | 07. Sliding Contacts/Fretting | |
| 10:00 | | Coffee Break |
| 10:30 | 08. Reliability/Environmental | |
| 12:30 | | Lunch |
| 13:30 | 09. Modelling and Simulation | |
| 15:30 | | Coffee Break |
| 16:00 | 10. Power Contacts | |
| 19:00 | Conference Dinner | |
| | (Ball room Maritim) | |
| Thursday, June | 26, 2014 | |
| 7:30 | Registration | |
| 8:00 | 11. New Technologies | |
| 10:00 | | Coffee Break |
| 10:30 | 12. Arc Interruption/Materials | |
| 11:50 | Closing Session | |
| 12:00 | | Lunch |
| 13:00-19:00 | Technical Program (Tour) | |

Conference ICEC 2014 Program

Monday, June 23, 2014

8:00 - 10:00

10:00 - 10:30

Registration

Room: Plenary

Opening Session – Welcome

W. Johler, Chairman of the International Advisory Group F. Ruchay, stellv. Leiter des Amtes für Wirtschaftsförderung der Stadt Dresden F. Berger, Conference Chairman

10:30 - 12:30

Room: Plenary

01. Fundamentals

Chairman: J. B. P. Williamson, Williamson Interface Ltd., UK Co-Chairman: K.-H. Schröder, Germany

- 10:30 The Threshold Welding Current for Large Area Closed Contacts with Two or Three points of Contact P. G. Slade, FIEEE, USA
- 10:50 Enhancing the contact interface by matching the surface pressure and current density distribution *M. Leidner, H. Schmidt, S. Sachs, S. Thoss, Tyco Electronics AMP GmbH, Germany; M. Myers, TE Connectivity, USA*
- 11:10 The Influence of Multiscale Roughness on the Real Contact Area and Contact Resistance between Real Reference Surfaces X. Zhang, R. L. Jackson, Auburn University, USA

11:30 Increased contact resistance of switching contacts

during current carrying M. Weis, AC²T research GmbH, Austria; W. Johler,

M. Weis, AC²T research GmbH, Austria; W. Jonier, TE Connectivity Solutions GmbH, Switzerland

11:50 Oxygen diffusion process on the copper surface by contact resistance *H. Kikuchi, I. Minowa, Tamagawa University, Japan*

Original Plane Arrest Foregoin Foregoing of in Model

12:10 Contact Blow-Apart Forces: Experience in Molded Case Circuit Breaker Contact Systems J. Ferree, Siemens Industry Inc., USA; M. Anheuser, L. Petrovic, Siemens AG, Germany

Lunch

^{12:30 - 13:30} Room: Exhibition

02. Materials I

Chairman: R. S. Timsit, Timron Scientific Consulting Inc., Canada Co-Chairman: P. Braumann, Germany

- 13:30 A Switchgear Manufacture's Perspective of Contact Material Requirements S. Kosse, W. Hartmann, N. Wenzel, C. Schuh, M. Anheuser, Siemens AG, Germany
- 13:50 New microstructure investigations of arc damaged silver/tinoxide electrodes by means of FIBtechnique

C. Selzner, F. Mücklich, Saarland University, Germany

14:10 Optimisation of material erosion and welding performance by metal oxides and magnetic particles

E. Yee Kin Choi, C. Bourda, A. Vassa, Metalor Technologies, France; E. Carvou, J. B. Mitchell, University of Rennes 1, France; N. Benjemaa, Contelec, France

14:30 An evaluation of Ag/W and Ag/Metal Oxide arcing contact combinations for circuit breaker applications

> C. Leung, T. Bergemann, Metalor Technologies, USA; C. Bourda, Metalor Technologies, France

14:50 Contact Material Effects on Dynamic Contact Sticking

T. Mützel, M. Bender, R. Niederreuther, Umicore AG & Co. KG, Germany

15:10 Welding Behavior in Making and Breaking Operations of Electrical Contacts

Q. Wang, C. Liu, Z. Li, D. Liu, L. Jinyou, Y. Xiaocheng, Huazhong University of Science and Technology, China; X. Wu, Wuhan University of Technology, China

15:30 - 16:00

Room: Exhibition

Coffee Break

16:00 - 18:00

03. Connectors

Chairman: P. van Dijk, PVDIJK B.V., 's-Hertogenbosch, Netherlands Co-Chairman: I. Buresch, Wieland Werke AG, Germany

- 16:00 Electrical behavior of golden automotive connectors under vibration tests S. Noël, A. Brézard-Oudot, Laboratoire de Génie Electrique de Paris Supélec, France
- 16:20 Novel Silver-Palladium Electrolyte for Electrical Contacts

F. Talgner, U. Manz, S. Berger, B. Weyhmüller, Umicore Galvanotechnik GmbH, Germany; A. Pfund, Forschungsinstitut Edelmetalle und Metallchemie, Germany

16:40 Connector Level Performance Evaluation of a New High Speed Reel to Reel Electroplated Silver Palladium Alloy Contact Finish *M. Myers, TE Connectivity, USA; H. Schmidt, TE Connectivity, Germany*

- 17:00 Prediction of Force-Displacement Relation of Stamped Spring of Copper-based Materials Y. Hattori, K. Furukawa, AutoNetworks Technologies, Ltd., Japan; H. Hamasaki, F. Yoshida, Hiroshima University, Japan
- 17:20 Failure Mechanism of Sliding Electrical Contacts with Various Plated Materials Y. Zhou, B. Yao, S. Ge, C. Hong, J. Zhang, Beijing University of Posts and Telecommunications, China
- 17:40 The electrical contact resistance endurance of heterogeneous Ag/Sn interfaces subjected to fretting wear

O. Perrinet, J. Laporte, S. Fouvry, LTDS, Ecole Centrale de Lyon, France; O. Alquier, PSA - Centre Technique, France

18:00 - 20:00

Room: Exhibition

Get Together and Poster Session with Buffet (please see page 20 ff. for poster title and authors)

Tuesday, June 24, 2014

7:30 - 10:00

Registration

8:00 - 10:00

Room: Plenary

04. Arc Interruption/DC

Chairman: B. Miedzinski, Wroclaw University of Technology, Poland Co-Chairman: M. Anheuser, Siemens AG, Germany

- 08:00 Hybrid switches in protective devices for low-voltage DC grids at commercial used buildings P. Meckler, F. Gerdinand, E-T-A GmbH, Germany; R. Weiss, Siemens AG, Germany; U. Boeke, Philips Group Innovation-Research, Netherlands; A. Mauder, Infineon Technologies AG, Germany
- 08:20 Breaking performance of protection devices for automotive dc powertrains with a voltage of 450 V H. Köpf, E.-D. Wilkening, C. Klosinski, M. Kurrat, University of Braunschweig, Germany
- 08:40 Electro-mechanical properties and welding characteristics of Ag/MoS₂, Ag/WS₂, Ag/CNTs and Ag/CdO materials for high-DC current contact applications

J. Jaćimović, E. Giannini, J. Teyssier, Université de Genève, Switzerland; L. Felberbaum, Sécheron SA, Switzerland

09:00 Break arc behaviors of Ag and AgSnO₂ contact pairs under different contact opening speeds in DC load circuits

M. Hasegawa, Chitose Institute of Science and Technology, Japan

09:20 Development of a compact Relay for High Voltage Switching of up to 1000 V and 40 A

D. Volm, F. Winkler, Panasonic Electric Works Europe AG, Germany

09:40 Development of arc-free DC300V/30A electromechanical devices using transient current switching circuits

N. Wakatsuki, T. Kudo, D. Hara, Ishinomaki Senshu University, Japan

Room: Exhibition

10:00 - 10:30

Coffee Break

05. Contact/Connectors

Chairman: W. Johler, Tyco Electronics Logistics AG, Switzerland Co-Chairman: H. Schmidt, Tyco Electronics AMP GmbH, Germany

10:30 Electrical and Tribological Characteristics of Copper Containing Diamond-like Carbon Nanocomposite Coating on Brass Substrate Sliding against Brass Ball

R. Hombo, N. Kato, T. Nozu, N. Inayoshi, Denso Corporation, Japan; T. Takeno, H. Miki, T. Takagi, Tohoku University, Japan; J. Fontaine, M. Belin, LTDS, France

10:50 Numerical Simulation and experimental verification for Contact Spot Temperature and Electrical Contact Resistance of Rivet contacts W. Ren, H. Zhi, S. Xue, G. Zhai, Harbin Institute of Technology, China; J. Song, Ostwestfalen-Lippe University of Applied Sciences, Germany

- 11:10 Formation and properties of intermetallic compounds in an Al-Cu roll bonded connection E. Hilz, S. Dudziak, Robert Bosch GmbH, Germany; R. Schmid-Fetzer, Clausthal University of Technology, Germany
- 11:30 Development of Tin-Seal Technology for Gold Reduction in Gold-Nickel Contacts G. J. S. Chou, TE Connectivity, USA
- 11:50 Yellowishing of Tin Coatings at elevated Temperatures I. Buresch, Wieland Werke AG, Germany
- 12:10 Analysis of temporal and spatial contact voltage fluctuation during fretting in automotive connectors *S. El Mossouess, E. Carvou, R. El Abdi, H. Obame, Université de Rennes 1, France; N. Benjemâa, Entreprise Contelec, France; L. Doublet, T. Rodari, Entreprise Valeo, France*
- 12:30 13:30 Room: Exhibition

Lunch

06. Materials II/Vacuum and refractory contacts

Chairman: P. G. Slade, FIEEE, USA Co-Chairman: V. Behrens, Doduco GmbH, Germany

- 13:30 Lifetime Improvement of Pd-Alloy Contact Pins with the New Design of Rounded Tip and Rh Plating *G. Dandong, W. Xiaojun, L. C. Ping, G. S. Lee, Infineon Technologies Asia Pacific Pte Ltd, Singapore*
- 13:50 Doped Cu/Cr vacuum interrupter contact material enables increased short-circuit interruption performance

R. A. Simon, T. Delachaux, T. Schmoelzer, M. Boehm, ABB Corporate Research, Switzerland; D. Gentsch, ABB Calor Emag Medium Voltage Products, Germany

14:10 Correlation between microstructural features of the melt zone and switching behavior in CuCr contact material

K. v. Klinski-Wetzel, M. Heilmaier, Karlsruhe Institute of Technology, Germany; C. Kowanda, F. E. H. Mueller, Plansee Powertech AG, Switzerland; T. Rettenmaier, V. Hinrichsen, Darmstadt University of Technology, Germany

14:30 Increase in contact resistance of vacuum interrupters after short-circuit testing E. D. Taylor, S. A. Baus, A. Lawall, Siemens AG, Germany

14:50 The aging of the power contacts caused by switching current

P. Borkowski, E. Walczuk, Lodz University of Technology, Poland; K. Frydman, D. Wojcik-Grzybek, Institute of Electronic Materials Technology, Poland

15:10 Usefulness of laminated Cu-Mo Composite as a contact material for low voltage power contactors B. Miedzinski, P. Wojtas, J. Wosik, A. Kozlowski, Institute of Innovative Technologies, EMAG, Poland; A. Grodzinski, Tele and Radio Research Institute, Poland; N. I. Grechanyuk, Institute of Material Science, Ukraine

| 15:30 - 16:00 | Room: Exhibition | |
|---------------|------------------|--|
| Coffee Break | | |

16:00 - 17:00

Room: Plenary

Albert-Keil-Ceremony

17:00 - 19:00

Room: Exhibition

Poster Session

(please see page 20 ff. for poster title and authors)

Wednesday, June 25, 2014

7:30 - 8:00

Registration

8:00 am - 10:00 am

Room: Plenary

07. Sliding Contacts/Fretting

Chairman: L. Sjögren, Swerea KIMAB AB, Sweden Co-Chairman: B. Martin, IMS Connector Systems GmbH, Germany

- 08:00 Effect of contact force and velocity on copper sliding contact under inductive arcing H. E. Obame, E. Carvou, University of Rennes1, France
- 08:20 **Synthesis and tribo-electric characterization of copper-graphite-composites with interpenetrating microstructure for sliding contacts** *M. Klement, O. Lott, A. Nagel, Hochschule Aalen, Germany*
- 08:40 Nanoindentation analysis of cold welding effects in sliding contact systems C. Holzapfel, Schleifring und Apparatebau GmbH, Germany
- 09:00 A wear tolerant slip-ring assembly individual spring-wire brushes in a v-grooved metal-graphite ring *M. Grandin, U. Wiklund, Uppsala University, Sweden*
- 09:20 **The role of microstructure and surface topography in the electrical behavior of Sn-coated Cu contacts** *K. E. Trinh, F. Mücklich, Saarland University, Germany; E. Ramos-Moore, Pontificia Universidad Católica de Chile, Chile*
- 09:40 Effect of Arc Discharge on the Wear Profile of Cu Impregnated Carbon Based Pantograph Contact Strip Y. Kubota, T. Hayasaka, T. Miyauchi, Railway Technical

Y. Kubota, I. Hayasaka, I. Miyauchi, Railway Technical Research Institute Tokyo, Japan; H. Nozaki, T. Hirai, T. Matsumoto, Toyo Tanso Co. Ltd, Japan

10:00 - 10:30

Room: Exhibition

Coffee Break

13

Room: Exhibition

08. Reliability/Environmental

Chairman: M. Runde, SINTEF Energiforskning AS, Norway Co-Chairman: C. Holzapfel, Schleifring und Apparatebau GmH, Germany

- 10:30 From fretting to connector vibration tests: a "transfer function" approach to predict the electrical contact resistance endurance S. Fouvry, P. Jedrzejczyk, LTDS, France; P. Chalandon, O. Alquier, PSA - Centre Technique, France
- 10:50 Failure Analysis at Electrical Contacts in Information Technologies: Part 1: Techniques B. Hagenhoff, Tascon GmbH, Germany
- 11:10 Failure Analysis at Electrical Contacts in Information Technologies: Part 2: Examples W. Schmitt, V. Behrens, J. Schreiber, Doduco GmbH, Germany
- 11:30 **The Effects of Induced Defects on Pore Corrosion** *R. Martens, A. Loyd, J. Hemond, TE Connectivity, USA*
- 11:50 Reliability assessment and field failure predictions – a prognostic model for separable electrical contacts F. Ostendorf, T. Wielsch, M. Reiniger, Weidmueller

Interface GmbH & Co. KG, Germany

- 12:10 A Study on Effect of Small Relay Housing Seal on Contact Resistance at Inductive Load K. Miyanaga, K. Takahashi, S. Takano, Y. Kurata, T. Takano, S. Aoki, Fujitsu Component Limited, Japan
- 12:30 13:30

Lunch

09. Modelling and Simulation

Chairman: F. Berger, Technische Universität Ilmenau, Germany Co-Chairman: B. Gehlert, W. C. Heraeus GmbH, Germany

- 13:30 Low-voltage circuit breaker arc simulation including contact arm motion C. Ruempler, Eaton Corporate Research & Technology, USA; A. Zacharias, H. Stammberger, Eaton Industries GmbH, Germany
- 13:50 Significance of resistances of switching contacts for the temperature rise of LV circuit breakers D. Siegel, M. Anheuser, Siemens AG, Germany
- 14:10 Controlling the repulsive Holm force between fixed and moving contact members in a low voltage switching device G. Eriksson, E. Johansson, ABB Corporate Research, Sweden
- 14:30 Impact of inhomogeneous material description for punched edges on the force-fitting simulation of copper high current connectors *E. Aristizabal, F. Günter, Robert Bosch GmbH, Germany; P. Schaaf, Technische Universität Ilmenau, Germany*
- 14:50 A Mathematical Approach to Evaluate Arc Immobility Time in Low Voltage Circuit Breakers S. Chandran, B. Shankaranarayanamoorthy, V. Subramanian, Larsen and Toubro Limited, India
- 15:10 Thermal inertia of direct current arcs at different contact material

M. Streck, F. Berger, Technische Universität Ilmenau, Germany

15:30 - 16:00 Room: Exhibition

Coffee Break

10. Power Contacts

Chairman: J.-G. Zhang, Beijing University of Posts & Telecommunications, China Co-Chairman: T. J. Schoepf, Eaton Corporation, USA

- 16:00 Evaluation of Electrical Contacts Using an X-Ray CT 3D Visualisation Technique J. Swingler, C. Roussos, Heriot-Watt University, UK
- 16:20 Effects of Temperature and Particle Orientation on the Electrical Conductivity of Heterogeneous Contact Materials E. R. Crandall, V. Behrens, J. Schreiber, T. Honig,

Doduco GmbH, Germany

16:40 Development of a Novel Highly Conductive Aluminum Particle based Filler for Low Density Conductive Composites

D. Freckmann, M. Myers, TE Connectivity, USA; H. Schmidt, TE Connectivity, Germany

17:00 Contact Resistance and Overtemperature Behavior of New and pre-Arced Power Engineering Contacts as a Function of Ambient Temperature and Contact Force

J. Schreiber, V. Behrens, T. Honig, M. Finkbeiner, Doduco GmbH, Germany

17:20 Impact of the Temperature-Induced Reduction of Joint Force on the Long-Term Behavior of Contact Elements with Material-Allocated Electrical and Mechanical Function

> M. Gatzsche, N. Lücke, S. Großmann, Technische Universität Dresden, Germany; T. Ledermann, G. Freudiger, Multi-Contact AG, Switzerland

17:40 Measurement of the amount of liquid created by an electric arc: case of a copper anode. Assessment of the power balance

R. Landfried, T. Leblanc, P. Teste, Université Paris, France

19:00 - 23:00

Room: Ball room inside Conference Center

Conference Dinner

Thursday, June 26, 2014

7:30 - 8:00

Registration

8:00 - 10:00

Room: Plenary

11. New Technologies

Chairman: H. Inoue, Akita University, Japan Co-Chairman: P. Meckler, E-T-A GmbH, Germany

08:00 **Time-current tripping characteristics at series arcing for Arc Fault Detection Devices** *J.-M. Martel, M. Anheuser, Siemens AG, Germany; F. Berger, Technische Universität Ilmenau, Germany*

- 08:20 Arc Fault Detection a Model-based Approach C. Strobl, E-T-A GmbH, Germany
- 08:40 Digital Closed Loop Control Technology for the AC Contactors Z. Xu, T. Longfei, Fuzhou University, China
- 09:00 Simulation-based Analysis of Inductance at Loose Connector Contact Boundaries T. Sato, Y. Hayashi, T. Mizuki, H. Sone, Tohoku University, Japan
- 09:20 Micro-contact Resistance of Au-Au on Engineered Contact Surfaces using Gray-scale Lithography C. Stilson, R. Coutu, Air Force Institute of Technology, USA
- 09:40 Lifetime Testing of a Development MEMS Switch Incorporating Au/MWCNT Composite Contacts A. P. Lewis, M. P. Down, C. Chianrabutra, L. Jiang, S. M. Spearing, J. W. McBride, University of Southhampton, UK

10:00 - 10:30

Room: Exhibition

Coffee Break

12. Arc Interruption/Materials

Chairman: N. Ben Jemaa, University of Rennes I, France Co-Chairman: S. Großmann, TU Dresden, Germany

- 10:30 Effects of switching speed on arcing and contact erosions in residential circuit breakers *G. Yang, Siemens Industry, USA*
- 10:50 **Re-ignition and Post Arc Current Phenomena in Low Voltage Circuit Breaker** *W. Hauer, Eaton Industries, Austria; X. Zhou, Corporate Research & Technology – Eaton, USA*
- 11:10 Ablation-Assisted Current Interruption in a Medium Voltage Load Break Switch

E. Jonsson, G. J. Gjendal, Norwegian University of Science and Technology, Norway; M. Runde, SINTEF Energy Research, Norway

11:30 Increased requirements on the switching behaviour of industrial switchgear caused by new high-efficiency motors

> A. Krätzschmar, W. Feil, R. Herbst, H. Klann, T. Viehauser, Siemens AG, Germany

11:50 - 12:00 Room: Plenary

Closing Session

12:00 - 13:00

Room: Exhibition

Lunch

Technical Program

Executive tram ride tour to "Gläserne Manufaktur Dresden" (Volkswagen Transparent Factory)

Volkswagen plant completed in 2002 for finishing fabrication of the luxury car "Phaeton", fascinating combination of technology and design as well as the world of processing and experience, place of many events. Spare capacity was also used to construct Bentley Continental Flying Spur vehicles destined for the European market until 2006, when all work was transferred to Bentley's plant in Crewe, England.

The guided tour includes a coffee break.

Afterwards an excursion with test demonstration of the high voltage station laboratory at TU Dresden is planned.

Departure: June 26, 2014 at 13:00.

Meeting point: in front of the Maritim Congress Center

Duration: 6 hours

Price: included in conference registration, students on request, limited space

Poster Session

P01 Fundamentals

P01.1 Observation of copper oxide film destruction process by applied DC voltage and current measured by nonlinear distortion methods

H. Kikuchi, I. Minowa, Tamagawa University, Japan

P01.2 Electrical and thermal behaviour of electrical joints with normal- and superconducting materials at low temperatures

> K. Bäuml, Schneider Electric Sachsenwerk GmbH, Germany; A. Ramonat, S. Großmann, Technische Universität Dresden, Germany

- P01.3 Effects of Temperatures and Leadframe Surfaces on Wear Rate of the Palladium Alloy Contact Pin W. Xiaojun, G. Dandong, Y. Alfred, L. Benedict, Infineon Technologies Asia Pacific Pte Ltd, Singapore
- P01.4 Contact Resistance of Vacuum Interrupters for Electric Power Systems in Liquid Nitrogen at Direct and Alternating Current K. Golde, V. Hinrichsen, Technische Universität

Darmstadt, Germany

P01.5 HF Characterization of Low Current DC Arcs at Alterable Conditions

> M. Wendl, M. Weiss, Robert Bosch GmbH, Germany; F. Berger, Technische Universität Ilmenau, Germany

P02 Materials

P02.1 Numerical microstructure analysis of Ag/WC/C contact material

I. Streit, Siemens AG, Germany

P02.2 Nanocrystalline Ag-Re composite as a potential material for electric contacts fabrication

D. Kołacz, S. Księżarek, M. Czepelak, M. Staszewski, M. Kamińska, K. Rudnicki, K. Bilewska, Institute of Non-Ferrous Metals, Gliwice, Poland; J. Karwan-Baczewska, AGH University of Science and Technology, Poland; P. Borkowski, A. Sienicki, Lodz University of Technology, Poland

- P02.3 Solid-state impact sintering in vacuum of composites based on copper and silver A. Laptiev, O. Tolochyn, O. Khomenko, L. Kryachko, Frantsevich Institute for Problems of Materials Science, Ukraine
- P02.4 On the Temperature Dependence of the Photoelectric Work Function of Contact Materials *M. Akbi, Laboratoire Arc Electrique et Plasmas Thermiques, CNRS, France*
- P02.5 Characterization of Intermetallic Compounds in AI-Ag Bimetallic Interfaces S. Pfeifer, S. Großmann, Technische Universität Dresden, Germany; H. Willing, H. Kappl, Forschungsinstitut für Edelmetalle + Metallchemie, Germany
- P02.6 Long Term Behavior of Electrical Contacts with Crossed Rods under Various Environmental Conditions

S. Dreier, N. Lücke, S. Großmann, Technische Universität Dresden, Germany

- P02.7 Comparison between nickel and silver as coating materials of conductors made of copper or aluminium used in electric power engineering *T. Fuhrmann, S. Schlegel, S. Großmann, Technische* Universität Dresden, Germany; M. Hoidis, ABB Switzerland Ltd., Switzerland
- P02.8 Fundamental Study of Electrical Sliding Contacts Comprising a Au-coated Slip Ring and Au Brush T. Ueno, Nippon Institute of Technology, Japan; M. Aoyagi, K. Sawa, N. Morita, Motor & Carbon Brush Lab. Co. Ltd., Japan

P02.9 Effect of Atmospheric Temperature on Contact Resistance of Sliding Contacts Using a Ag-Coated Slip Ring and a Ag-Graphite Brush M. Fuchimoto, K. Sawa, T. Ueno, Nippon Institute of Technology, Japan

P03 Connectors

P03.1 Optimization of the Number of Contact Springs in a Connector by means of Analytical and Numerical Analysis

> M. Blauth, J. Song, Ostwestfalen-Lippe University of Applied Sciences, Germany; F. Berger, Technische Universität Ilmenau, Germany

P03.2 Investigations on the threshold range of connectors in conditions of engaging and separating with electrical load

> A. Hornung, F. Berger, Technische Universität Ilmenau, Germany; G. Freudiger, D. Kummerer, T. Ledermann, Multi-Contact AG, Switzerland

P03.3 Degradation Phenomenon of Electrical Contacts by a Micro-Sliding Mechanism – The comparison of the evaluated minimal sliding amplitudes under some conditions using the mechanism

> S. Wada, TMC System Co. Ltd., Japan; K. Sawa, Nippon Institute of Technology, Japan

P08 Reliability / Environmental

- P08.1 **One early short circuit current detection (ESCD) method based on the energy change** *D. Feng, C. Weigang, J. Ma, Z. Yue, Siemens Ltd. China; M. Anheuser, Siemens AG, Germany*
- P08.2 Reliability test and reliability evaluation methods of AC contactor

W. Lili, Z. Yixuan, Hebei University of Technology, China; L. Bin, Suzhou Tianye Electric Appliance Co., Ltd., China

P08.3 Mechanical Characterisation and Optimisation of Carbon Nanotube Composite Surfaces of Electrical Contact

M. P. Down, R. Cook, L. Jiang, University of Southampton, UK; J. W. McBride, University of Southampton Malaysian Campus, Malaysia

P08.4 A simple test method for the welding degradation of arcing contacts

M. Böhm, P. Morin, T. Schmölzer, R. A. Simon, ABB Corporate Research, Switzerland; D. Gentsch, ABB Calor Emag Medium Voltage Products, Germany

P09 Modeling and Simulation

- P09.1 Nonequilibrium arc model for the description of arc-electrode interaction
 S. Gorchakov, M. Baeva, R. Kozakov, D. Uhrlandt,
 T. Schoenemann, Leibniz Institute for Plasma Science and Technology, Germany
- P09.2 Simulation of relay contact bouncing including a short arc model

R. Haase, F. Berger, Technische Universität Ilmenau, Germany

P09.3 Studies on the use of heat pipes in medium voltage switchgears G. Kitzrow, W. Wiebel, R.-D. Rogler, HTW Dresden,

Germany; T. Schoenemann, University of Rostock, Germany

- P09.4 Analysis of electrode heating processes in the switching contacts of vacuum circuit breakers
 S. Gorchakov, D. Uhrlandt, K.-D. Weltmann,
 T. Schoenemann, Leibniz Institute for Plasma Science and Technology, Germany; X. Godechot,
 S. Chakraborty, S. Kantas, H. Schellekens, Schneider Electric, France
- P09.5 The initial contact stress in aluminum compression connections with high temperature low sag conductors

C. Hildmann, S. Großmann, Technische Universität Dresden, Germany; T. Dockhorn, 50Hertz Transmission GmbH, Germany

P09.6 Adaptive real-time DWT-based method for arc fault detection

P. Qi, J. Lezama, S. Jovanovic, P. Schweitzer, Université de Lorraine, France

P09.7 **Time-dependent Contact Resistance in a Multi-scale Surface Model** *A. Goedecke, G. Bachmaier, Siemens Corporate Technology, Germany; R. L. Jackson, Auburn University, USA*

P09.8 **Sheath layer modeling for switching arcs** *B. Barbu, F. Berger, Technische Universität Ilmenau, Germany*

P11 New Technology

P11.1 Reliability Evolution of Au-Au, Au-Ru and Au-RuO₂ Micro-Contacts C. Stilson, R. Coutu, Air Force Institute of Technology,

C. Stilson, R. Coutu, Air Force institute of Technology, USA

P11.2 Arcing Detection at Home System Using Correlation analysis

J. L. Calvo, P. Schweitzer, S. Weber, E. Tisserand, Université de Lorraine, France; P. Joyeux, Hager Electro SAS, France

P11.3 Vehicle power supply cable with optical jacket monitoring and arcing interference detection *M. Viehmann, C. Kloß, B. Lustermann, University of Applied Science Nordhausen, Germany*

P12 Arc Interruption / Design

- P12.1 Current Communication in High Voltage Switchgear Contacts Under High Currents C. Fnineche, O. Aitken, W. Grieshaber, Alstom Grid, France
- P12.2 Arcing Behaviours in the HV Gas-blast interrupters near the downstream contact with cavity S. Averyanova, V. Frolov, E. Tonkonogov, Politechnical University, St.Petersburg, Russia
- P12.3 New Deion Chamber for Encapsulated Switchgear A. Ehrhardt, S. Beier, DEHN+SÖHNE GmbH+Co. KG, Germany
- P12.4 Observations on switching characteristics of arc chutes in DC contactors

J. Jebramcik, F. Berger, Technische Universität Ilmenau, Germany

- P12.5 Analysis of Selectivity Concepts for Moulded Case Circuit Breakers Y. Zhu, M. Hein, W. Erven, M. Anheuser, Siemens AG, Germany
- P12.6 Visualisation of arc running on divergent electrodes and extinction in the arc splitter chamber C. Drebenstedt, M. Rock, Technische Universität Ilmenau, Germany; A. Ehrhardt, S. Beier, DEHN + SÖHNE GmbH + Co. KG, Germany

- P12.7 Application of the CCS-RTOS in the self-correction intelligent control module of AC contactors *T. Longfei, Z. Xu, Fuzhou University, China*
- P12.8 Arc Blowing for Different Shape Silver-Tin Dioxide Contacts using External DC Magnetic Field Y. Kayano, H. Inoue, Akita University, Japan
- P12.9 Magnetic Switch Mechanism for Circuit Breakers E. Bindl, H. Neubert, J. Lienig, Technische Universität Dresden, Germany; A. Krätzschmar, S. Beyer, Siemens AG, Germany
- P12.10 Optimising the magnetic field system of a high voltage relay without protective gas R. Pimenta, L. Hofmeister, E-T-A GmbH, Germany
- P12.11 Dynamic Analysis of a Drive Unit for Molded Case Circuit Breakers with Electromagnetic Repulsion Forces I. C. Ahn, J. S. Kang, B. D. Kim, Hvundai Heavy

т. С. Ann, J. S. Kang, B. D. Kim, Hyundai Heavy Industries, Co., Ltd., South Korea

- P12.12 **Spark gaps for DC applications** *A. Ehrhardt, S. Beier, DEHN+SÖHNE GmbH+Co.KG, Germany*
- P12.13 Fundamental Arc Characteristics at DC Current Interruption of Low Voltage (<500V) K. Sawa, M. Tsuruoka, S. Yamashita, Nippon Electric Control Equipment Industries Association (NECA), Japan
- P12.14 Laser imaging technology for analysis of electric arc behavior in low voltage circuit breakers H. Chen, T. Martin, J. Bennett, Siemens Industry, Inc., USA
- P12.15 A Study of Electrode Mass Change and Arc Energy of AgNi Contacts for Electromagnetic Contactor K. Yoshida, K. Sawa, Nippon Institute of Technology, Japan; K. Suzuki, K. Takaya, Fuji Electric FA Components & Systems Co., Ltd., Japan
- P12.16 SAXS Measurements and Mapping of Particle Size Distributions of Nanoparticles Formed in Arcs between AgSnO₂, Ag and Carbon Electrodes E. Carvou, J. L. Le Garrec, E. Yee Kin Choi,

J. B. A. Mitchell, University of Rennes, France

General Information

Contact

For detailed information please contact:

VDE-Conference Services Ms Jasmin Kayadelen Stresemannallee 15 60596 Frankfurt Germany Phone: +49-(0)69-6308-275 Fax: +49-(0)69-6308-144 E-mail: jasmin.kayadelen@vde.com

Website

Visit the ICEC 2014 homepage for getting the latest information related to the conference: www.icec2014.org

Registration

Please visit www.icec2014.org for registration and information regarding the registration.

Payment

Payment for registration, including bank charges and processing fees, must be made in Euro.

The conference fee has to be fully paid in advance.

Proceedings

All papers/posters accepted for presentation at the conference will be published as CD ROM and included in IEEE Xplore. The CD ROM will be handed on-site to all participants attending the conference. In case you would like to have a printed proceeding, please book it in advance through the additional booking link (price/each 100,00 \in)

Proceedings will also be on sale during the conference (upon availability).

Badge

Delegates will receive badges for the conference showing their name and company. All participants are kindly requested to wear their badge throughout the conference and exhibition, even at social events. Lost badges will not be replaced.

Hotel Reservation

For room reservation please check our Website www.icec2014.org \rightarrow Accommodation.

Dresden

Dresden is an important center of culture business and research in the east of Germany. The city of Dresden, known as a "baroque city", has world famous landmarks, the church "Frauenkirche", the Semper Opera House and the Castle. Forty museums and many private galleries mainly dedicated to contemporary art have given Dresden the reputation of being a city of culture and arts.

Conference Venue

The Maritim Hotel & International Congress Centre Dresden is located in a tranquil spot right on the banks of the Elbe and not far from the attractions of the historic old city. The "Semperoper", the "Frauenkirche" ("Church of Our Lady"), the Green Vault and much more are just a few minutes away on foot. The attractive and architecturally unique building is the ideal starting point for all travel occasions.

Maritim Hotel & Internationales Congress Center Dresden Ostra-Ufer 2 / Devrientstr. 10 - 12 01067 Dresden Phone: + 49 (0) 351 216-0 E-Mail: info.dre@maritim.de

Registration Desk Hours

| Sunday, | June 22, 2014 | 17:00 - 19:00 |
|------------|---------------|---------------|
| Monday, | June 23, 2014 | 7:30 - 18:00 |
| Tuesday, | June 24, 2014 | 7:30 - 17:00 |
| Wednesday, | June 25, 2014 | 7:30 - 17:00 |
| Thursday, | June 26, 2014 | 7:30 - 13:00 |

Availability e-mail on-site

E-mail: vde-conferences@vde.com

jasmin.kayadelen@vde.com

Official language

The official conference language is English. All sessions will be held in English with simultaneous translation into German.

Social Program

Monday June 23, 2014

Get Together (18:00 - 20:00)

A welcome reception will be offered to delegates, exhibitors and registered accompanying persons at the exhibition area. All participants are invited to attend this reception. (Except only student's registration without extra badge)

Tuesday June 24, 2014

Albert-Keil-Ceremony (16:00 - 17:00)

For all participants. The Ceremony takes place in the plenary room.

Poster Session (17:00 - 19:00) For all participants and exhibitors.

Meeting and Dinner Advisory Group

For Advisory Group members only. The meetings takes place from 17:00 - 18:00.

Departure for the dinner event will be at 19:30 at the Maritim hotel.

Wednesday June 25, 2014

Conference Dinner (19:00 - 23:00)

The conference dinner will take place at the conference venue. The conference dinner ticket is included in the conference participation (Except only student's registration and for accompanying persons)

Thursday June 26, 2014

Technical Program (13:00 - 19:00)

Executive tram ride tour to "Gläserne Manufaktur Dresden" (Volkswagen Transparent Factory)

Volkswagen plant completed in 2002 for finishing fabrication of the luxury car "Phaeton", fascinating combination of technology and design as well as the world of processing and experience, place of many events. Spare capacity was also used to construct Bentley Continental Flying Spur vehicles destined for the European market until 2006, when all work was transferred to Bentley's plant in Crewe, UK.

The guided tour includes a coffee break.

Afterwards an excursion with test demonstration of the high voltage station at TU Dresden is planned.

| Departure: | June 26, 2014 at 13:00. |
|----------------|---|
| Meeting point: | in front of the Maritim Congress Center |
| Duration: | 6 hours |
| Price: | included in conference registration, students |
| | on request |

Insurance

The organizers may not be held responsible for any injury to participants or damage, theft and loss of personal belongings. Participants should therefore make their own insurance arrangements.

Emergency Calls

Fire/Ambulance 112 Police 110

From some phones an additional "0" (0112 or 0110) might be required to place a call

Tipping

Tipping is at your own discretion. In Germany all taxes are included in hotel and restaurant bills. A good service may be rounded up by 5 to 10%.

Transport

Busses and trams from airport: S1 to stop "Bahnhof Mitte"

ICD address for navigation: Maritim Hotel & Internationales Congress Center Dresden

Exhibition

The conference will be accompanied with an applicationoriented exhibition.

Coffee and lunch breaks will be held in the exhibition area.

Any inquiries relating to ICEC 2014 should be sent to:

VDE-Conference Services ICEC 2014 Stresemannallee 15 60596 Frankfurt Germany

Ms. Jasmin Kayadelen Phone: +49-(0)69-6308-275 FE-mail: vde-conferences@vde.com



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