

Program

**Electric Field Assisted Sintering and Related
Phenomena Far from Equilibrium**

March 6 – 11, 2016

**Hotel dos Templários
Tomar, Portugal**

Conference Chair

Rishi Raj

University of Colorado at Boulder, USA

Conference Co-Chair

Thomas Tsakalacos

Rutgers University, USA



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Sunday, March 6, 2016

16:00 – 18:00	Conference Check-in
18:00 – 19:30	Welcome Reception (Lobby Bar)
19:30 – 22:00	Dinner followed by Reception

NOTES

- Audiotaping, videotaping and photography of presentations are strictly prohibited.
- Speakers – Please leave at least 5 minutes for questions and discussion.
- Please do not smoke at any conference functions.
- Turn your cellular telephones to vibrate or off during technical sessions.
- Please write your name in the front of this booklet in case it is misplaced.
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Monday, March 7, 2016

- 07:30 – 08:30 Breakfast
- 08:30 – 08:35 Welcome – Conference Chairs
- Introductory Remarks:
ECI Liaison – Lawrence Kabacoff
- Session 1: Flash, Microwave, SPS and Grain Growth – I**
Session Chair: Rishi Raj, University of Colorado at Boulder, USA
- 08:35 – 09:05 **Electric field–induced electronic conduction in bulk oxide ceramics**
Anthony R. West, University of Sheffield, United Kingdom
- 09:05 – 09:35 **Flash microwave sintering of oxide ceramics**
Kirill I. Rybakov, Institute of Applied Physics, Russian Academy of Sciences;
Lobachevsky State University of Nizhny Novgorod, Russia
- 09:35 – 10:05 **Flash sintering of covalent non–oxide ceramics at low temperatures with low DC electric fields: An *in situ* EDXRD study by synchrotron probe**
Thomas Tsakalakos, Rutgers University, USA
- 10:05 – 10:25 Coffee Break
- 10:25 – 10:55 **Field–assisted and flash sintering of nanocrystalline yttria: Densification and microstructural evolution**
Hidehiro Yoshida, National Institute for Materials Science, Japan
- 10:55 – 11:25 **Electroluminescence and Heating Rates during Flash**
Rishi Raj, University of Colorado Boulder, USA
- 11:25 – 11:55 **Highly transparent spinel windows by microwave sintering**
Jasbinder Sanghera, Naval Research Laboratory, USA
- 11:55 – 12:25 Coffee Break
- 12:25 – 12:55 **The influence of fields and dopants on grain boundary mobility**
Wayne D. Kaplan, Technion – Israel Institute of Technology, Israel
- 12:55 – 13:25 **Spark plasma sintering of a functionally graded material consisting of a high–alloyed CrMnNi–steel and varying Mg–PSZ content**
Sabine Decker, Technical University Bergakademie Freiberg, Germany
- 13:25 – 14:30 Lunch

Monday, March 7, 2016 (continued)

Session 2: Flash, Microwave, SPS and Grain Growth – II

Session Chair: Thomas Tsakalakos, Rutgers University, USA

- 14:30 – 15:00 **Electrical conduction mechanism at high voltages and dielectric breakdown strength in bulk ceramic insulators**
Gerold A. Schneider, Hamburg University of Technology, Germany
- 15:00 – 15:30 **Oxygen vacancy formation due to DC electric fields during flash sintering in BaTiO₃**
Takahisa Yamamoto, Nagoya University, Japan
- 15:30 – 16:00 **Effect of electric field/current on liquid phase sintering**
Jesus Gonzalez-Julian, Forschungszentrum Jülich GmbH, Germany
- 16:00 – 16:30 Coffee Break
- 16:30 – 17:00 **Influence of an electric field on grain growth and sintering in strontium titanate**
Fabian Lemke, Karlsruhe Institute of Technology (KIT), Germany
- 17:00 – 17:30 **First stage in flash sintering of zirconia based ceramics**
Paul Carry, SIMaP Laboratory, France
- 17:30 – 18:00 **Effect of (external) electric fields on heterogeneous solid state reactions – Special role of grain boundary diffusion**
Carsten Korte, Forschungszentrum Jülich GmbH, Germany
- 18:00 – 18:30 Coffee Break
- 18:30 – 19:00 **Spark and plasma aided densification mechanisms during spark plasma sintering of ceramic powders**
Rachman Chaim, Technion–Israel Institute of Technology, Israel
- 19:00 – 19:30 **The modification of the temperature gradient in a large sample sintered by SPS**
Mirva Eriksson, Stockholm University, Sweden
- 19:30 – 21:00 Dinner
- 21:00 – 22:00 Social Hour

Tuesday, March 8, 2016

07:30 – 08:30 Breakfast

Session 3: Flash – Various (Experimental)

Session Chair: Antti Makinen, Office of Naval Research, USA

08:30 – 09:00 **Field and thermal factors in field-assisted consolidation of powder materials**
Eugene Olevsky, San Diego State University, USA

09:00 – 09:30 **Direct microwave sintering of gamma-alumina powder: Effect of alpha seeding and magnesia doping**
Paul Carry, SIMaP Laboratory, France

09:30 – 10:00 **Phase transformations in real time during flash**
Jean-Marie Lebrun, University of Colorado, USA

10:00 – 10:30 Coffee Break

10:30 – 11:00 **Role of defects in electric-field-assisted sintering**
Steve Hellberg, Naval Research Laboratory, USA

11:00 – 11:30 **Flash sintering of complex oxides**
Luis Perez-Maqueda, Materials Institute, Spain

11:30 – 12:00 Coffee Break

12:00 – 12:30 **Electric field-assisted flash sintering of fine-grained and high-permittivity $\text{CaCu}_3\text{Ti}_4\text{O}_{12}$ electroceramics**
Lilian M. Jesus, University of São Paulo, Brazil

12:30 – 13:00 **Flash sintering of ZnO, TiO_2 and other oxides: The origin of onset flash and effects of atmosphere, doping and particle size**
Jian Luo, University of California San Diego, USA

13:00 – 13:30 **Estimating ionic conductivity during flash sintering of 8ysz**
Daniel Marinha, Saint-Gobain CREE, France

13:30 – 14:30 Lunch

14:30 – 19:00 Afternoon guided excursion to the Templar Castle (Convento de Cristo), a UNESCO World Heritage Site

19:30 – 21:00 Dinner on your own

21:00 – 22:00 Social Hour

Wednesday, March 9, 2016

07:30 – 08:30 Breakfast

Session 4: Flash and SPS – Various

Session Chair: Lawrence Kabacoff, USA

08:30 – 09:00 **Flash sintering of glass containing alumina bodies**

Mattia Biesuz, University of Trento, Italy

09:00 – 09:30 **The influence of doping on flash sintering condition in $\text{SrTi}_{1-x}\text{Fe}_x\text{O}_{3-\delta}$**

Neta Shomrat, Technion, Israel

09:30 – 10:00 **Electric field effects on grain boundary formation and grain growth**

Klaus van Benthem, University of California Davis, USA

10:00 – 10:30 Coffee Break

10:30 – 11:00 **Flash obviates constrained sintering**

Rishi Raj, University of Colorado Boulder, USA

11:00 – 11:30 **Electrical field effects in spark plasma sintering of hyperstoichiometric UO_2**

Marco Cologna, European Commission, Joint Research Centre (JRC), Institute for Transuranium Elements (ITU), Germany

11:30 – 12:00 **Low-temperature spark plasma sintering of transparent ceramics by using SiC molding set**

Byung-Nam Kim, National Institute for Materials Science, Japan

12:00 – 12:30 **Electric current as a driving force for interphase growth in spark plasma sintered dielectric composites**

Catherine Elissalde, ICMCB-CNRS, France

12:30 – 13:00 **Discoloration of spark-plasma-sintered transparent MgAl_2O_4 spinel**

Koji Morita, National Institute for Materials Science, Japan

13:00 – 14:30 Lunch

Session 5: SPS – Various

Session Chair: Claude Estournès, Université de Toulouse; UPS, INP; Institut Carnot Cirimat, France

14:30 – 15:00 **Engineering of lightweight ceramic composites by spark plasma sintering**

Oleg Vasylykiv, National Institute for Materials Science, Japan

Wednesday, March 9, 2016 (continued)

- 15:00 – 15:30 **Development of electric current activated/assisted sintering (ECAS/SPS)**
Salvatore Grasso for Yoshio Sakka, National Institute for Materials Science,
Japan
- 15:30 – 16:00 **Benefits of SPS sintering on microstructure and piezoelectric properties of
KNN-based ceramics**
Florian Jean, GREMAN, France
- 16:00 – 16:30 Coffee Break
- 16:30 – 17:00 **Generating MgAl₂O₄ whiskers using carbothermic reactions and SPS/FAST**
Anton Salomon, TU Bergakademie Freiberg, Germany
- 17:00 – 17:30 **The mechanisms of field assisted sintering in metallic systems**
Johannes Trapp, TU Dresden IfWW, Germany
- 17:30 – 18:00 **Microscopic densification mechanisms of metallic systems by spark
plasma sintering**
Jean-Philippe Monchoux, Centre d'élaboration de matériaux et d'études
structurales, France
- 18:00 – 18:30 Coffee Break
- 18:30 – 19:00 **Exploring length scale–property relationships in dense nanocrystalline
materials**
Javier Garay, University of California, San Diego, USA
- 19:00 – 19:30 **SPS for chemical preparations**
Ihor Veremchuk, Max Planck Institute for Chemical Physics of Solids, Germany
- 19:30 – 20:00 **Ceramics of potassium sodium niobate by field–assisted sintering
techniques: Spark plasma sintering versus spark plasma texturing**
Paula Maria Vilarinho, University of Aveiro, Portugal
- 20:00 – 21:00 Dinner
- 21:00 – 22:30 Poster Session / Social Hour

Thursday, March 10, 2016

07:30 – 08:30

Breakfast

Session 6: Techniques, Methods and Simulations–I

Session Chair: Michael Bakas, Army Research Office, USA

08:30 – 09:00

Microstructure evolution in spark plasma sintered hafnium–tantalum carbides

Ben Boesl, Florida International University, USA

09:00 – 09:30

Consolidation behavior of bulk amorphous glasses and foils: The effect of current on devitrification kinetics

Olivia A. Graeve, University of California, San Diego, USA

09:30 – 10:00

Processing high strength low oxide and metal impurity ZrB₂ ceramics using boron carbide and spark plasma sintering

Erica L. Corral, University of Arizona, USA

10:00 – 10:30

Coffee Break

10:30 – 11:00

Hybrid heated FAST/SPS with additional voltage support

Jan Raethel, Fraunhofer IKTS, Dresden, Germany

11:00 – 11:30

A dynamic bifurcation criterion for thermal runaway during the flash sintering of ceramics

Joao Gustavo Pereira da Silva, TUHH, Germany

11:30 – 12:00

Coffee Break

12:00 – 12:30

Hybrid heated FAST/SPS with additional voltage support

Jan Raethel, Fraunhofer IKTS, Dresden, Germany

12:30 – 14:00

Lunch

Session 7: Techniques, Methods and Simulations–II

Session Chair: Olivier Guillon, Forschungszentrum Jülich GmbH, Germany

14:00 – 14:30

Field effects during consolidation of metallic powders

Brandon McWilliams, US Army Research Laboratory, USA

14:30 – 15:00

Microwave and flash processing of functional materials: Are there (m)any similarities?

Bala Vaidhyanathan, Loughborough University, United Kingdom

15:00 – 15:30

Flash sintering: New opportunities

Salvatore Grasso, Queen Mary University of London (QMUL), United Kingdom

Thursday, March 10, 2016 (continued)

- 15:30 – 16:00 **Ceramics sintering and shaping using the electrical field assisted sintering method**
Amiya Mukherjee, University of California, USA
- 16:00 – 16:30 Coffee Break
- 16:30 – 17:00 **Spark plasma sintering: Comparison between a fully coupled process numerical simulation and experimental data**
David Martins, CEMEF / CIRIMAT / SAFRAN, France
- 17:00 – 17:30 **Growing larger: Scaling up during spark plasma sintering of high-temperature ceramics**
Oleg Vasykiv, National Institute for Materials Science, Japan
- 17:30 – 18:00 **Energy coupled to matter for field-assisted processing**
Raymond Brennan, U.S. Army Research Laboratory, USA
- 18:00 – 18:30 Coffee Break
- 18:30 – 19:00 **Energy coupled to matter for field-assisted processing**
Raymond Brennan, U.S. Army Research Laboratory, USA
- 19:00 – 19:30 **Field assisted sintering: Challenges in scale-up from buttons to body armor**
Christopher D. Haines, US Army ARDEC, USA
- 19:30 – 21:30 Banquet followed by Social Hour

Friday, March 11, 2016

07:30 – 08:30 Breakfast

Session 8: Innovative Materials

Session Chair: Rolf Janssen, TUHH, Germany

08:30 – 09:00 **Modelling and FEM simulation of electric field assisted sintering of tungsten carbide (WC)**

Sree Koundinya Sistla, RWTH–Aachen University, Germany

09:00 – 09:30 **Spark plasma sintering: From the thermal gradient to advanced ceramic composites**

Dmytro Demirskyi, Nanyang Technological University, Singapore

09:30 – 10:00 **Densification of dense nano crystalline zinc oxide under electric field**

Olivier Guillon, Forschungszentrum Jülich GmbH, Germany

10:00 – 10:30 Coffee Break

10:30 – 11:00 **Features of grain growth and grain boundary formation under microwave and spark plasma sintering conditions**

Andrey Ragulya, Institute for Problems of Materials Science (IPMS), Ukraine

11:00 – 11:30 **Fabrication of a vitreous porcelain by conventional sintering and spark plasma sintering**

Wirat Lerdprom, Imperial College London, United Kingdom

11:30 – 12:00 **Application of microwave energy to consolidate titanium powder**

Christopher Haines, US Army ARDEC, USA

12:00 – 12:30 **Modification of the interdiffusion process in the Fe–Al system by SPS and field assisted sintering**

Hanka Becker, Technical University Bergakademie Freiberg, Germany

12:30 – 13:00 **Application of steel as an alternative tool material for field assisted sintering in SPA**

Alexander Laptev, Forschungszentrum Julich GmbH, Germany

13:00 – 13:30 **Abnormal grain growth in pressure assisted sintering of BaLa₄Ti₄O₁₅**

Ana Senos, University of Aveiro/ CICECO, Portugal

13:30 Lunch and Departure

Poster Session

Session Chair: Rolf Janssen, TUHH, Germany

1. **Flash sintering of SrTiO₃**
Fabian Lemke, KIT, Germany
2. **Flash sintering of TCP bioceramics: Effect of particle size and influence on $\beta \rightarrow \alpha$ transition**
Matteo Frasnelli, DII - University of Trento, Italy
3. **FAST sintering of alumina, spinel and yttria-stabilized zirconia three-phase composites**
David Kok, University of California, Irvine, USA
- 4.
5. **Fast one-step synthesis and sintering of materials promoted by electric fields**
Lilian M. Jesus, University of São Paulo, Brazil
- 6.
- 7.
8. **Observations on Flash Sintering of Uranium Dioxide**
Kenneth J. McClellan, Los Alamos National Laboratory, USA
9. **Microstructure and mechanical properties of Spark Plasma Sintered tungsten-copper-zinc composites**
Thabiso Langa, Tshwane University of Technology, South Africa
10. **Self-organized structure in current-activated pressure-assisted densification (CAPAD)**
Sebastian Angst, University of Duisburg-Essen, German
- 11.
- 12.
- 13.
- 14.
15. **Growth behavior of faceted Na_{1/2}Bi_{1/2}TiO₃-BaTiO₃ grains in single and two-step sintering in support for the microstructural evolution principle**
Seok-Young Ko, Korea Advanced Institute of Science and Technology (KAIST), South Korea