

PROGRAM BOOK



The 11th Pacific Rim Conference of Ceramic Societies

# PACRIM 11

August 30 ~ September 4, 2015

ICC Jeju, Jeju, Korea

Organized by  Korean Ceramic Society

Supported by      

Member Societies    

## Symposium 6:

# Synthesis and Processing of Materials using SPS

## [WeL1] Fundamentals and Modeling

Room L (3F, Samda B)

Session Chair:

Javier Garay (University of California, Riverside, USA), Takashi Goto (Tohoku University, Japan)

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08:30-09:00

[WeL1-1] Recent Progress of Spark Plasma Sintering (SPS) Method and Potentials for the Manufacturing Onan Industrial Scale of Advanced Materials [Invited]

Masao Tokita  
*NJS Co.,Ltd., Japan*

09:00-09:30

[WeL1-2] Field and Thermal Factors Affecting Field-Assisted Consolidation of Powder Materials [Invited]

Eugene Olevsky  
*San Diego State University, USA*

09:30-09:50

[WeL1-3] Finite Element Modeling of CAPAD: The Effect Material Properties on Temperature and Stress Gradients

M Shachar, Y Kodera, C Hardin, A Dupuy, and J. E. Garay  
*University of California, Riverside, USA*

09:50-10:20

[WeL1-4] Synthesis and Consolidation of Meta-Stable Materials using CAPAD [Invited]

Yasuhiro Kodera, Anthony Fong, and Javier E. Garay  
*University of California, Riverside, USA*

## Symposium 6:

# Synthesis and Processing of Materials using SPS

## [WeL2] Mechanism and Microstructure (1)

Room L (3F, Samda B)

Session Chair:

Javier Garay (University of California, Riverside, USA)

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10:30-11:00

[WeL2-1] An Overlooked Phenomenon in Spark Plasma Sintering [Invited]

Zhijian Shen

*Stockholm University, Sweden*

11:00-11:30

[WeL2-2] Development of Electric Current Activated/Assisted Sintering (ECAS, SPS) [Invited]

Yoshio Sakka<sup>1</sup> and Salvatore Grasso<sup>2</sup>

<sup>1</sup>National Institute for Materials Science, Japan, <sup>2</sup>Queen Mary University, UK

11:30-11:50

[WeL2-3] Structure and Properties of Advanced Materials Obtained by Spark Plasma Sintering

Vladimir Chuvildeev, Maxim Boldin, Aleksey Nokhrin, Yuri Blagoveshchensky, Nikita Sakharov, Sergey Shotin, and Dmitry Kotkov  
*Lobachevsky State University of Nizhni Novgorod, Russia*

11:50-12:10 **CANCELLED**

[WeL2-4] Flash Sintering of ZrO<sub>2</sub> with Y<sub>2</sub>O<sub>3</sub> Dopant

Jinling Liu<sup>1</sup>, Dianguang Liu<sup>2</sup>, Yiguang Wang<sup>2</sup>, and Linan An<sup>3</sup>

<sup>1</sup>Southwest Jiaotong University, China, <sup>2</sup>Northwestern Polytechnical University, China, <sup>3</sup>University of Central Florida, USA

## Symposium 6:

# Synthesis and Processing of Materials using SPS

## [WeL3] Mechanism and Microstructure (2)

Room L (3F, Samda B)

Session Chair:

Makoto Nanko (Nagaoka University of Technology, Japan)

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14:00-14:30

[WeL3-1] Mechanisms of Pore Formation During Spark Plasma Sintering of Ultra-high Hardness Metallic and Ceramic Materials [Invited]

Olivia A. Graeve and James P. Kelly

*University of California, San Diego, USA*

14:30-15:00

[WeL3-2] Functional Materials Processed by Spark Plasma Texturing and Sintering [Invited]

Jacques. G Noudem

*CNRS, France*

15:00-15:30

[WeL3-3] Mechanical Behavior of Spark Plasma Sintered Functionally Graded Nanocomposites [Invited]

Hansang Kwon<sup>1</sup>, Akira Kawasaki<sup>2</sup>, and Marc Leparoux<sup>3</sup>

*<sup>1</sup>Pukyong National University, Korea, <sup>2</sup>Tohoku University, Japan, <sup>3</sup>EMPA, Switzerland*



## Symposium 6:

# Synthesis and Processing of Materials using SPS

## [ThL1] Structural Non-Oxide Materials

Room L (3F, Samda B)

Session Chair:

Jacques Noudem (CNRS, France)

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08:30–09:00

[ThL1-1] Densification and Microstructural Design of Ceramics Assisted by Electric Current/Field [Invited]

Salvatore Grasso, Theo Saunders, Ben Milsom, and Michael Reece  
*Queen Mary, University of London, UK*

09:00–09:30

[ThL1-2] Consolidation of Silicon Carbide and Nitride with Transformation without Additive by SPS [Invited]

Manshi Ohyanagi<sup>1</sup>, Mutsuki Kaneko<sup>1</sup>, Shotaro Yano<sup>1</sup>, and Zuhair Munir<sup>2</sup>  
<sup>1</sup>*Ryukoku University, Japan*, <sup>2</sup>*University of California, Davis, USA*

09:30–09:50

[ThL1-3] Effects of Aging Treatment on Phase Decomposition of TiC–ZrC Solid Solution Prepared by Spark Plasma Sintering

Ying Li, Hirokazu Katsui, and Takashi Goto  
*Tohoku University, Japan*

## Symposium 6:

# Synthesis and Processing of Materials using SPS

## [ThL2] Functional Oxide and Non-Oxide Materials

Room L (3F, Samda B)

Session Chair:

Michael Reece (Queen Mary, University of London, UK)

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10:30-11:00

[ThL2-1] Fabrication of Dense  $\text{Eu}^{2+}$  Doped  $\text{CaSiAlN}_3$  Ceramics by Spark Plasma Sintering [Invited]

Junichi Tatami<sup>1</sup>, Kentaro Iwai<sup>1</sup>, Motoyuki Iijima<sup>1</sup>, and Takuma Takahashi<sup>2</sup>

<sup>1</sup>Yokohama National University, Japan, <sup>2</sup>Kanagawa Academy of Science and Technology, Japan

11:00-11:30

[ThL2-2] Densification Behaviors of Electrically Conductive Powders Sintered by Directly Applied Current Heating Process [Invited]

Mikio Ito

## Symposium 6:

# Synthesis and Processing of Materials using SPS

## [ThL3] Property and Microstructure, Oxide Materials (1)

Room L (3F, Samda B)

Session Chair:

Junichi Tatami (Yokohama National University, Japan)

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14:00-14:30

[ThL3-1] Pulsed Electric-Current Pressure Sintering of  $ZrO_2(Y_2O_3)-Al_2O_3$  Solid Solution Powders Prepared by the Neutralization Co-Precipitation Method [Invited]

Ken Hirota<sup>1</sup>, Kenta Yamamoto<sup>1</sup>, Koki Sasai<sup>1</sup>, Masaki Kato<sup>1</sup>, Hideki Taguchi<sup>1</sup>, Hideo Kimura<sup>2</sup>, Masayuki Takai<sup>2</sup>, and Masao Terada<sup>2</sup>  
<sup>1</sup>Doshisha University, Japan, <sup>2</sup>Daiichi Kigenso Kagaku Kogyo, Japan

14:30-15:00

[ThL3-2] Consolidation of Iron Oxides by using Pulsed Electric Current Sintering [Invited]

Makoto Nanko  
Nagaoka University of Technology, Japan

15:00-15:20

[ThL3-3] Electric Field Effects on Spinel Structure

Shai Meir and Shmuel Hayun  
Ben-Gurion University of the Negev, Israel

15:20-15:40

[ThL3-4] Fabrication of Electrically Conductive Alumina Doped with a Novel Type of Alumina Nanofibers Coated with Few Layers of Graphene

Maria Drozdova<sup>1</sup>, Domingo Pérez-Coll<sup>2</sup>, Marina Aghayan<sup>1</sup>, Roman Ivanov<sup>1</sup>, Miguel Angel Rodríguez<sup>2</sup>, and Irina Hussainova<sup>1</sup>  
<sup>1</sup>Tallinn University of Technology, Estonia, <sup>2</sup>Institute of Ceramics and Glass (ICV-CSIC), Spain

15:40-16:00

[ThL3-5] Densification, Structure and Dielectric Properties of  $0.7CaTiO_3-0.3NdAlO_3$  Based Microwave Ceramics by Spark Plasma Sintering

Lijin Cheng, Shaowen Jiang, and Shaojun Liu

## Symposium 6:

# Synthesis and Processing of Materials using SPS

## [FrL1] Property and Microstructure, Oxide Materials (2)

Room L (3F, Samda B)

Session Chair:

Koji Morita (National Institute for Materials Science, Japan)

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08:30-08:50

[FrL1-1] Carbon Contamination in Oxide Ceramics Fabricated by Spark-Plasma-Sintering (SPS) Processing

Koji Morita, Byung-Nam Kim, Hidehiro Yoshida, Keijiro Hiraga, and Yoshio Sakka  
*National Institute for Materials Science, Japan*

08:50-09:20

[FrL1-2] How Spark Plasma Sintering (SPS) can be used to Tune the Ferroelectric/Dielectric Composites Properties? [Invited]

Claude Estournes<sup>1</sup>, Romain Epherre<sup>1</sup>, Gilles Philippot<sup>2</sup>, Marjorie Albino<sup>2</sup>, Julie Lesueur<sup>2</sup>, U-Chan Chung<sup>2</sup>, Geoffroy Chevallier<sup>1</sup>, Alicia Weibel<sup>1</sup>, Alain Peigney<sup>1</sup>, Liliana Mitoseriu<sup>3</sup>, Mario Maglione<sup>2</sup>, Cyril Aymonier<sup>2</sup>, Doninique Bernard<sup>2</sup>, and Catherine Elissalde<sup>2</sup>  
<sup>1</sup>CIRIMAT, France, <sup>2</sup>ICMCB, France, <sup>3</sup>University "Alexandru Ioan Cuza", Rumania

09:20-09:50

[FrL1-3] Unusual Grain Growth during Spark Plasma Sintering of Alumina [Invited]

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

09:50-10:10 **CANCELLED**

[FrL1-4] Quasi-Intrinsic Colossal Permittivity in Nb and In Co-Doped Rutile TiO<sub>2</sub> Nanoceramics Synthesized through Oxalate Chemical-Solution Route Combined with Spark Plasma Sintering

Hyuksu Han<sup>1</sup>, Dufor Pascal<sup>1</sup>, Sungwook Mhin<sup>2</sup>, Christophe Tenailleau<sup>1</sup>, and Sophie Guillemet-Fritsch<sup>1</sup>  
<sup>1</sup>CIRIMAT, France, <sup>2</sup>Korea Institute of Industrial Technology, Korea



WP1-28. Carbon Coated  $\text{Li}_2\text{MnSiO}_4$  Spheres-Graphene Composite and its Application as a Cathode Material for Lithium Ion Batteries  
Donghyeok Shin, Hyunjung Park, and Ungyu Paik  
Hanyang University, Korea

WP1-29. Synthesis and Luminescence Properties of Red-Emitting  $\text{Ca}_{14}\text{Zn}_6\text{Al}_{10}\text{O}_{35}:\text{Mn}^{2+}$  phosphor for Plant Cultivation  
Yelim Song, Minji Lee, Young Hyun Song, Takaki Masaki, and Dae Ho Yoon  
Sungkyunkwan University, Korea

WP1-30. Fabrication of Phosphor in Glass with Yellow-Emitting  $\text{Y}_3\text{Al}_5\text{O}_{12}:\text{Ce}^{3+}$  Phosphor for LED  
Minji Lee, Yelim Song, Young Hyun Song, and Dae Ho Yoon  
Sungkyunkwan University, Korea

WP1-31. The Mixture Effect of Manosized Recycle and Commercial WC Powder on the Mechanical and Structural Properties  
Man Gyu Hur, Hyung Sup Lim, Deug Joeng Kim, and Dae Ho Yoon  
Sungkyunkwan University, Korea

WP1-32. Fabrication and Magnetic Properties of Fe/TiO<sub>2</sub> Core/Shell Powder  
Sunwoo Lee<sup>1</sup>, Sungjoon Choi<sup>1</sup>, Hui Eun Kim<sup>1</sup>, Sang-Kyun Kwon<sup>2</sup>, and Sang-Im Yoo<sup>1</sup>  
<sup>1</sup>Seoul National University, Korea, <sup>2</sup>Samsung Electro-Mechanics, Korea

WP1-33. Fabrication and magnetic properties of TiO<sub>2</sub>-Coated Fe Alloy Powder  
Sung Joon Choi<sup>1</sup>, Sunwoo Lee<sup>1</sup>, Hui Eun Kim<sup>1</sup>, Sang-Kyun Kwon<sup>2</sup>, and Sang-Im Yoo<sup>1</sup>  
<sup>1</sup>Seoul National University, Korea, <sup>2</sup>Samsung Electro-Mechanics, Korea

WP1-34. Preparation of Ceramic Mold for Fracture Strength using Inorganic Precursor  
Geun-Ho Cho, Jing Li, Sung-Hoon Jung, Eun-Hee Kim, and Yeon-Gil Jung  
Changwon National University, Korea

WP1-35. The Effect of the Interaction Forces between CeO<sub>2</sub> and SiO<sub>2</sub> on the Step Height Reduction during STI CMP  
Kangchun Lee, Jihoon Seo, Kijung Kim, Yoonsung Jo, Jinok Moon, and Ungyu Paik  
Hanyang University, Korea

WP1-36. Development of Biocompatible Binder based Ceramic Extrusion and Investigation of its Properties  
Seho Sun<sup>1</sup>, Junghyun Choi<sup>1</sup>, Joo Hyun Kim<sup>1</sup>, Dowon Song<sup>1</sup>, Jeong-Gu Yeo<sup>2</sup>, and Ungyu Paik<sup>1</sup>  
<sup>1</sup>Hanyang University, Korea, <sup>2</sup>Korea Institute of Energy Research, Korea

WP1-37. Effect of SiO<sub>2</sub> Addition on Sintering Behavior of Zircon  
Ho Su Jang  
Keimyung University, Korea

WP1-38. Application of A New Inorganic Binder System for High Functional Ceramic Core in Thin-Wall Casting  
Jing Li, Geun-Ho Cho, Eun-Hee Kim, and Yeon-Gil Jung  
Changwon National University, Korea

WP1-39. Synthesis of  $\text{Ca}_{2-x}/2(\text{Si}_{1-x}\text{P}_x)\text{O}_4:\text{Eu}^{2+}$  Green Phosphor and influence of P<sup>5+</sup> Ion on Luminescence Intensity  
Syohhei Furuya<sup>1</sup>, Nobuyuki Yokoyama<sup>1</sup>, Hiromi Nakano<sup>1</sup>, Hiroki Banno<sup>2</sup>, and Koichiro Fukuda<sup>2</sup>  
<sup>1</sup>Toyoashi University of Technology, Japan, <sup>2</sup>Nagoya Institute of Technology, Japan

WP1-40. Influence of Pr<sup>3+</sup> Co-Doping on Photoluminescence Intensity of  $\text{Li}_{1.1}\text{Ta}_{0.89}\text{Ti}_{0.11}\text{O}_3:\text{Eu}^{3+}$  phosphor  
Syohhei Furuya<sup>1</sup>, Nobuyuki Yokoyama<sup>1</sup>, Hiromi Nakano<sup>1</sup>, and Shinobu Fujihara<sup>2</sup>  
<sup>1</sup>Toyoashi University of Technology, Japan, <sup>2</sup>Keio University, Japan

WP1-41. Characteristics of Ti-1C Mo Alloy Powders and their Sintered Bodies Prepared from Scraps and Commercial Powders  
Kil-Min Roh, In-Hyeok Choi, Jung-Min Oh, Hanjung Kwon, Wonbeak Kim, and Chang-Yeol Suh  
Korea Institute of Geoscience and Mineral Resources, Korea

WP1-42. Synthesis and Characterization of Magnesia Doped Zirconia by Ball Mill Assisted Co-Precipitation Method  
Sukhbayer Gankhuyag and Dong Sik Bae  
Changwon National University, Korea

WP1-43. Effect of Debinding Conditions on Properties of SUS316L/Binder Manufactured by Metal Injection Molding  
Jang Woo Lee<sup>1</sup>, Sung Jae Kim<sup>1</sup>, Sang Suk Kim<sup>2</sup>, Sung Jo Kim<sup>2</sup>, and Bon Heun Koo<sup>1</sup>  
<sup>1</sup>Changwon National University, Korea, <sup>2</sup>Sam-Won Tech, Korea

WP1-44. Effect of Carbon Additives on Pore Geometry of a High Density Graphite Anode for Lithium-Ion Batteries  
Changju Lee, Hyungkyu Han, and Ungyu Paik  
Hanyang University, Korea

WP1-45. Porous Mullite/Alumina Composites Fabricated by Freeze Casting with Camphene/TBA Mixed Solution  
Kyu Heon Kim, Seog Young Yoon, and Hong Chae Park  
Pusan National University, Korea

WP1-46. High Productive Ultra-Precision Manufacturing of Advanced Ceramic Materials  
Manuel Stompe and Lutz Rissing  
Leibniz University of Hanover, Germany

WP1-47. Rapid Synthesis of High Purity  $\beta$ -SiC Powder by the Microwave Heating Method  
Seok Heo, Woo-Teck Kwon, Young-Hee Kim, Soo-Ryong Kim, Dong-Geun Shin, and Yoon-Il Lee  
Korea Institute of Ceramic Engineering and Technology, Korea

#### Symposium 6:

#### Synthesis and Processing of Materials using SPS

WP1-48. Densification Phenomena of Hydroxyapatite Bioceramics during the Spark Plasma Sintering  
Seungchan Cho<sup>1</sup>, Ilguk Jo<sup>1</sup>, Sang-Bok Lee<sup>1</sup>, Sang-Kwan Lee<sup>1</sup>, Hansang Kwon<sup>2</sup>, Yangdo Kim<sup>3</sup>, and Akira Kawasaki<sup>4</sup>  
<sup>1</sup>Korea Institute of Materials Science, Korea, <sup>2</sup>Pukyong National University, Korea, <sup>3</sup>Pusan National University, Korea, <sup>4</sup>Tohoku University, Japan

WP1-49. A Study on the Spark Plasma Sintering of Mechanically-Alloyed Mo-Cu Powder  
Handan Lee<sup>1</sup>, Paik-Kyun Shin<sup>1</sup>, and Kyoung Il Moon<sup>1,2</sup>  
<sup>1</sup>Korea Institute of Industrial Technology, Korea, <sup>2</sup>Inha University, Korea

WP1-50. Directional Property Evolution of GNP-Reinforced HA Composites Consolidated by Spark Plasma Sintering  
Duk-Yeon Kim<sup>1</sup>, Indu Bajpai<sup>1</sup>, Young-Hwan Han<sup>1</sup>, Byung-Koog Jang<sup>2</sup>, and Sukyoung Kim<sup>1</sup>  
<sup>1</sup>Yeungnam University, Korea, <sup>2</sup>National Institute for Materials Science, Japan

WP1-51. Characterization of Alumina/GNPs Consolidated by Spark Plasma Sintering  
Ji Hwoan Lee, Young-Hwan Han, and Sukyoung Kim  
Yeungnam University, Korea

WP1-52. The Microstructures of Spark Plasma Sintered Silicon Nitride with Al<sub>2</sub>O<sub>3</sub>-Er<sub>2</sub>O<sub>3</sub> Sintering Additives  
Sangha Park<sup>1</sup> and Sungsu Chun<sup>2</sup>  
<sup>1</sup>Daegu Mechatronics Materials Institute, Korea, <sup>2</sup>Yeungnam University, Korea

WP1-53. Investigation of Functionally Graded Dual-Nanoparticulate-Reinforced Aluminum Matrix Composites Fabricated by Spark Plasma Sintering.  
Chaeyoung Lee<sup>1</sup>, Kwonhoo Kim<sup>1</sup>, Marc Leparoux<sup>2</sup>, Akira Kawasaki<sup>3</sup>, and Hansang Kwon<sup>1</sup>  
<sup>1</sup>Pukyong National University, Korea, <sup>2</sup>EMPA, Switzerland, <sup>3</sup>Tohoku University, Japan

#### Symposium 7:

#### Novel Spray Coatings

WP1-54. Effect of Annealing on the Permittivity of Ceramic Films Prepared by the Aerosol Deposition Method  
Michael Schubert, Jörg Exner, and Ralf Moos  
University of Bayreuth, Germany