

# **28th International Symposium on Superconductivity (ISS 2015)**

Physics Procedia Volume 81

Tokyo, Japan  
16 - 18 November 2015

## **Editors:**

**Naoyuki Amemiya  
Keiichi Tanabe**

ISBN: 978-1-5108-2403-4

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© by Elsevier B.V.  
All rights reserved.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact Elsevier B.V.  
at the address below.

Elsevier B.V.  
Radarweg 29  
Amsterdam 1043 NX  
The Netherlands

Phone: +31 20 485 3911  
Fax: +31 20 485 2457

<http://www.elsevierpublishingsolutions.com/contact.asp>

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## Contents

### 1. Physics and chemistry

#### 1.1 Superconductivity -theory-

Band-renormalization Effect on Relationship between Superconductivity and Antiferromagnetism in <i>t-J</i> Model K. Kobayashi, R. Sato, H. Yokoyama . . . . .	1
Variational Study of Magnetic Ordered State in <i>d-p</i> Model S. Tamura, H. Yokoyama . . . . .	5
Predominance of Antiferromagnetism in Two-dimensional Underdoped Hubbard Model H. Yokoyama, R. Sato, K. Kobayashi . . . . .	9
Loop Current and Antiferromagnetic States in Fermionic Hubbard Model with Staggered Flux at Half Filling Y. Toga, H. Yokoyama . . . . .	13
Unitary-transformed Fermions Theory of Iron-based Superconductors K. Nishi . . . . .	17
Superconductivity in an Effective Model Derived from Wannier Orbitals for an Organic Conductor (TMTSF) <sub>2</sub> ClO <sub>4</sub> H. Aizawa, K. Kuroki . . . . .	21
Collective Modes in the TRSB Phase of Multiband Superconductors T. Koyama . . . . .	25
Odd-frequency Spin-triplet Superconductivity in Nano-sized Superconductors under a Magnetic Field: Effects of Phonons M. Kashiwagi, M. Kato . . . . .	29

#### 1.2 Cuprate superconductors -experiment-

Optimization of YbBa <sub>2</sub> Cu <sub>3</sub> O <sub>y</sub> Thick Film Formation on MgO Substrates S. Kawata, M. Muralidhar, M. Jirsa, K. Inoue, M. Murakami . . . . .	33
Effect of Pr Additions to Li-doped Bi2212 Bulk Superconductors Sintered at Low Temperature A. Miura, D. Oikawa, H. Andoh, T. Sugiura, T. Tsukamoto . . . . .	37
SEM and SEM by EDX Analysis of Air-Processed SmBa <sub>2</sub> Cu <sub>3</sub> O <sub>y</sub> K. Kasuga, M. Muralidhar, P. Diko, M. Jirsa, K. Inoue, M. Murakami . . . . .	41
Uniform Magnetic Field between Face-to-Face HTS Bulk Magnets Combining Concave and Convex Magnetic Field Distributions T. Oka, Y. Takahashi, S. Yaginuma, J. Ogawa, S. Fukui, T. Sato, K. Yokoyama, T. Nakamura . . . . .	45

#### 1.3 Other superconductors -experiment-

Change of the Surface Structure by F Doping in BiS <sub>2</sub> -Based Superconductor CeO <sub>1-x</sub> F <sub>x</sub> BiS <sub>2</sub> S. Demura, Y. Fujisawa, T. Machida, M. Nagao, Y. Takano, H. Sakata . . . . .	49
Single-crystal Growth and Superconducting State of LaO <sub>0.5</sub> F <sub>0.5</sub> Bi(S <sub>0.8</sub> Se <sub>0.2</sub> ) <sub>2</sub> Y. Terui, K. Saito, N. Kase, T. Nakano, N. Takeda . . . . .	53
Superconducting and Normal State Properties in the Ternary Silicide NbIrSi, TaIrSi and NbPtSi H. Suzuki, N. Kase, T. Nakano, N. Takeda . . . . .	57
Thermal Conductivity Measurements of Caged Structural Superconductors H. Matsuzaki, K. Hida, N. Kase, T. Nakano, N. Takeda . . . . .	61
Type-II Superconductivity in Ternary Zirconium Pnictide Chalcogenide Single Crystals M. Baenitz, K. Lüders, R. Kniep, F. Steglich, M. Schmidt . . . . .	65
Evaluation of Trapped Magnetic Field Properties in Superconducting MgB <sub>2</sub> Bulk Magnets of Various Shapes by Finite Element Method Y. Hiramatsu, E.S. Otabe, M. Kiuchi . . . . .	69
Scanning Tunnelling Microscopy and Spectroscopy of the Layered Nitride Superconductor $\alpha$ -Na <sub>x</sub> TiNCl A. Sugimoto, Y. Sakai, T. Ekino, S. Zhang, M. Tanaka, S. Yamanaka, A.M. Gabovich . . . . .	73

#### 1.4 Vortex Physics

Transverse Components of Flux Line Lattice Form Factors in Uniaxial Superconductors M. Ichioka, Y. Amano, M. Ishihara, K. Machida . . . . .	77
--	----

In-plane Field Angle Dependence of the Critical Current of RBCO Wires at Low Temperatures S.C. Wimbush, N.M. Strickland, N.J. Long .....	81
Vortex Penetrations in Parallel-connected Two Stacks of Intrinsic Josephson Junctions S. Ooi, T. Mochiku, M. Tachiki, K. Hirata .....	85
Ginzburg-Landau Calculations of Star-shaped $\text{Mo}_{80}\text{Ge}_{20}$ Superconducting Small Plates H. Miyoshi, M. Kato, H.T. Huy, V.T. Dang, H. Matsumoto, N. Fujita, T. Ishida .....	89
Ginzburg-Landau Calculations of Circular $\text{Mo}_{80}\text{Ge}_{20}$ Plates with Sector Defect V.T. Dang, H.T. Huy, H. Matsumoto, H. Miyoshi, S. Miyajima, H. Shishido, M. Kato, T. Ishida .....	93
<b>2. Wires, Tapes and Characterization</b>	
<i>2.1 Processing of C.C.</i>	
Development of Long Coated Conductors with High In-field $I_c$ Performance by PLD Method at High Production Rate A. Ibi, T. Yoshida, T. Izumi, Y. Shiohara, D. Yokoe, T. Kato, T. Hirayama .....	97
Fabrication of $\text{GdBa}_2\text{Cu}_3\text{O}_y$ Films by Liquid-phase-assisted Metal-organic Deposition Using Fluorine-free Solutions Y. Okabe, Y. Yoshikawa, R. Kita, H. Kubo, O. Miura, K. Yamada, K. Kaneko .....	101
Jointing of Coated Conductors by Using Nano-particle Metal Pastes T. Nakanishi, T. Machi, T. Izumi, R. Teranishi, T. Kato, T. Kato, T. Hirayama .....	105
Joint of $\text{REBa}_2\text{Cu}_3\text{O}_{7-\delta}$ Coated Conductors Using Metal Organic Deposition K. Hiramatsu, R. Teranishi, K. Yamada, Y. Sato, K. Kaneko .....	109
<i>2.2 Characterization of C.C.</i>	
Microstructures of $\text{YBa}_2\text{Cu}_3\text{O}_y$ Layers Deposited on Conductive Layer-buffered Metal Tapes A. Ichinose, M. Hashimoto, S. Horii, T. Doi .....	113
Critical Current Properties in Longitudinal Magnetic Field of YBCO Superconductor with APC R. Kido, M. Kiuchi, E.S. Otabe, T. Matsushita, A.K. Jha, K. Matsumoto .....	117
AC Loss Calculation of REBCO Cables by the Combination of Electric Circuit Model and 2D Finite Element Method H. Noji .....	121
Characteristics of Critical Current of HTS Conductor on Round Core X. Zhan, L. Ren, Z. Wang, Y. Xu .....	125
<i>2.3 Processing &amp; Characterization of BSCCO &amp; <math>\text{MgB}_2</math> Wires &amp; others</i>	
Effect of $\text{SnO}$ , $\text{MgO}$ and $\text{Ag}_2\text{O}$ Mix-doping on the Formation and Superconducting Properties of Bi-2223 Ag/tapes X.Y. Lu, D. Yi, H. Chen, A. Nagata .....	129
<b>3. Thin Films and junctions</b>	
<i>3.1 Junctions</i>	
Polarization Enhancement of Terahertz Radiation Generated by Intrinsic Josephson Junctions in a Truncated Edge Square $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$ Mesa A. Elarabi, Y. Yoshioka, M. Tsujimoto, Y. Nakagawa, I. Kakeya .....	133
Heating Effect of Mesa-type Intrinsic Josephson Junction Stacks Using Pulse Current Measurement D. Oikawa, S. Iwatsuka, T. Sugiura, H. Andoh, T. Tsukamoto .....	137
<b>4. Electronic devices</b>	
<i>4.1 Digital Devices</i>	
Experimental Demonstration and Performance Estimation of a New Relaxation Oscillator Using a Superconducting Schmitt Trigger Inverter T. Onomi .....	141
<b>5. Large scale system applications</b>	
<i>5.1 Magnets and coils</i>	
R&D Progress of HTS Magnet Project for Ultrahigh-field MRI T. Tosaka, H. Miyazaki, S. Iwai, Y. Otani, M. Takahashi, K. Tasaki, S. Nomura, T. Kurusu, H. Ueda, S. Noguchi, A. Ishiyama, S. Urayama, H. Fukuyama .....	145
Design and Performance Analysis of an Iron Core-based No-Insulation HTS Magnet for HTS DC Induction Heating Machine J. Choi, K. Kim, S.-K. Kim, S. Kim, K. Sim, M. Park, I.-K. Yu .....	149
A Case Study of $\text{MgB}_2$ and HTS Magnets Being Cooled and Cooled Down Using a Hydrogen Thermal-siphon Cooling-loop with Coolers M.A. Green .....	154
Critical Current Test of Liquid Hydrogen Cooled HTC Superconductors under External Magnetic Field Y. Shirai, M. Shiotsu, H. Tatsumoto, H. Kobayashi, Y. Naruo, S. Nonaka, Y. Inatani .....	158
Development of HTS Magnet for Rotating Gantry K. Tasaki, K. Koyanagi, S.S. Takayama, Y. Ishii, T. Kurusu, N. Amemiya, T. Ogitsu, Y. Iwata, K. Noda .....	162

**5.2 Bulk characteristics**

Study on the Magnetic Field Homogeneity of Stacked HTS Bulk Magnets Including the Deteriorated HTS Bulk by Crack for Compact NMR Relaxometry

K. Hojo, S.B. Kim, D. Miyazawa, R. Nomura, S. Fukada . . . . .	166
One-dimensional Stress Evaluation of a Ring Bulk HTS with Shrinkage Fit by an Iron Ring M. Tsuchimoto, M. Morita . . . . .	170

**5.3 Rotating machine**

Experimental Manufacture and Performance Evaluation of Linear Switched Reluctance Motor with HTS Excitation Windings

T. Hirayama, S. Oto, A. Higashijima, S. Kawabata . . . . .	174
Study on Thrust Improvement and Ripple Suppression of HTS Linear Switched Reluctance Motor with Coreless HTS Excitation Windings S. Oto, T. Hirayama, S. Kawabata . . . . .	178

**5.4 Power transmission and distribution**

Construction and 1<sup>st</sup> Experiment of the 500-meter and 1000-meter DC Superconducting Power Cable in Ishikari

S. Yamaguchi, Y. Ivanov, H. Watanabe, N. Chikumoto, H. Koshiduka, K. Hayashi, T. Sawamura . . . . .	182
Multi-channel Data Acquisition System for a 500 m DC HTS Power Cable in Ishikari Y.V. Ivanov, N. Chikumoto, H. Watanabe, H. Takano, N. Inoue, S. Yamaguchi . . . . .	187

Dependence of DC HTS Cable Critical Current on the Temperature Distribution along the Cable

V.S. Vyatkin, J. Sun, Y.V. Ivanov, N. Chikumoto, H. Watanabe, O. Shyshkin, S. Yamaguchi . . . . .	191
---	-----

Computational Study on the Steady-state Impedance of Saturated-core Superconducting Fault Current Limiter

C. Zhang, Y. Tang, S. Liang, L. Ren, Z. Wang, Y. Xu . . . . .	195
The Method to Diagnose Local Abnormalities in Windings of High Temperature Superconducting Transformer During Load Changing K. Sakemoto, T. Kubo, A. Kawagoe . . . . .	199