CONTENTS

Preface xv
ICMC Awards xvii
2003 ICMC Board xix
2003 ICMC Program Committee and Technical Editors xx
Acknowledgments xxi

PART A

CRYOGENIC FUNCTIONAL MATERIALS

Magnetocaloric Effect at the Field-Induced First Order Transition in Rare Earth Metals and Alloys 3
Y. I. Spichkin and A. M. Tishin
Thermal Property of $Dy_xEr_{1-x}Al_2$ and $Gd_5(Si_xGe_{1-x})_4$ for Hydrogen Magnetic Refrigeration 11
K. Kamiya, T. Numazawa, T. Koen, T. Okano, and K. Matsumoto
Effect of Niobium Content on Shape Memory Characteristics of $(Ni_{47}Ti_{44})_{100-x}Nb_x$ Alloys 18
X. M. He, D. S. Yan, L. J. Rong, and Y. Y. Li
A Shape Memory Alloy Based Cryogenic Thermal Conduction Switch 26
V. B. Krishnan, J. D. Singh, T. R. Woodruff, W. U. Notardonato, and R. Vaidyanathan
Low Temperature Properties of Some Er-Rich Intermetallic Compounds 34
K. A. Gschneidner, Jr., A. O. Pecharsky, L. Hale, and V. K. Pecharsky
Measuring Residual Resistivity Ratio of High-Purity Nb 41
L. F. Goodrich, T. C. Stauffer, J. D. Splett, and D. F. Vecchia

CRYOGENIC MATERIALS TESTING

A Fully Automatic Press for Mechanical and Electrical Testing of Full-Size ITER Conductors under Transverse Cyclic Load 51
W. Abbas, A. Nijhuis, Y. Ilyin, B. ten Haken, and H. H. J. ten Kate
Axial Reverse-Cycle Fatigue Tests of High Strength Pulse Magnet Conductors at 77 K 59
R. P. Walsh and V. J. Toplosky
Fixture for Short Sample Testing of Modern High Energy Physics Nb_3Sn Strands 67
R. Soika, L. D. Cooley, A. K. Ghosh, and A. Werner
A Novel Sorbent Material Test Device at Variable Cryogenic Temperatures 75
C. Day and V. Hauer

Design and Rationale for an *In Situ* Cryogenic Deformation Capability at a Neutron Source 83
V. Livescu, T. R. Woodruff, B. Clausen, T. Sisneros, M. A. M. Bourke, W. U. Notardonato, and R. Vaidyanathan

PHYSICAL AND MECHANICAL PROPERTIES AT CRYOGENIC TEMPERATURES

Phase Stability of the Fe-Cr-Mn System and the Problem of Development of Stainless Steels on Its Basis 93
G. Grikurov, N. Antropov, I. Baratashvili, L. Skibina, M. Chernik, and K. Yushchenko
Microstructural Stability of 316 Stainless Steel during Long Term Exposure to High Magnetic Fields at Cryogenic Temperatures 98
A. Nishimura and T. Kakeshita
Notch Effects on High-Cycle Fatigue Properties of Titanium Alloy at Cryogenic Temperatures 106
T. Yuri, Y. Ono, and T. Ogata
Unique Cryogenic Welded Structures 114
K. A. Yushchenko and G. G. Monko
Data Sheet Program and Mechanical Properties of Ti-5Al-2.5Sn ELI and Alloy 718 at Cryogenic Temperatures 122
T. Ogata, T. Yuri, H. Sumiyoshi, Y. Ono, S. Matsuoka, and K. Okita
Effects of Co and Al Contents on Cryogenic Mechanical Properties and Hydrogen Embrittlement for Austenitic Alloys 130
X. Y. Li, L. M. Ma, and Y. Y. Li
Notch Effect on Tensile Deformation Behavior of 304L and 316L Steels in Liquid Helium and Hydrogen 137
K. Shibata and H. Fujii
Characterization of Alloys with Potential for Application in Cable-in-Conduit Conductors for High-Field Superconducting Magnets 145
R. P. Walsh, J. R. Miller, and V. J. Toplosky
Thermal Contraction Measurements of Various Materials Using High Resolution Extensometers between 290 K and 7 K 151
A. Nyilas
Anisotropic Constitutive Model of Strain-Induced Phenomena in Stainless Steels at Cryogenic Temperatures 159
C. Garion and B. Skoczen
Neutron Diffraction Characterization of Residual Strain in Welded Inconel 718 for NASA Space Shuttle Flow Liners 167
C. R. Rathod, V. Livescu, B. Clausen, M. A. M. Bourke, W. U. Notardonato, M. Femminineo, and R. Vaidyanathan
Tensile, Fracture, Fatigue Life, and Fatigue Crack Growth Rate Behavior of Structural Materials for the ITER Magnets: The European Contribution 176
A. Nyilas, K. Nikbin, A. Portone, and C. Sborchia

Electrical Properties of Sol-Gel MgO - ZrO_2 Insulation Coatings under Compression for Magnet Technology 184
O. Cakiroglu, L. Arda, Z. Aslanoglu, Y. Akin, O. Dur, A. Kaplan, and Y. S. Hascicek

NON-METALLIC MATERIALS — PROPERTIES

Low Temperature Thermal Conductivity of Woven Fabric Glass Fibre Composites 193
S. Kanagaraj and S. Pattanayak
Thermal Expansion of Glass Fabric-Epoxy Composites at Cryogenic Temperatures 201
S. Kanagaraj and S. Pattanayak
Low-Viscosity, Radiation-Resistant Resin System with Increased Toughness 209
R. P. Reed and D. Evans
Low Temperature Fatigue Properties of Advanced Cyanate-Ester Blends after Reactor Irradiation 217
K. Bittner-Rohrhofer, K. Humer, H. W. Weber, P. E. Fabian, N. A. Munshi, and S. W. Feucht
Effect of Mixed-Mode Ratio on Cryogenic Interlaminar Fracture Toughness of Woven Fabric Glass/Epoxy Laminates 224
Y. Shindo, K. Horiguchi, S. Kumagai, and D. Shinohe
An Investigation of the Cryogenic Freezing of Water in Non-Metallic Pipelines 232
C. I. Martin, R. N. Richardson, and R. J. Bowen
Experimental and Analytical Evaluation of the Notched Tensile Fracture of CFRP Woven Laminates at 77 K 240
S. Kumagai and Y. Shindo
The Thermo-Mechanical Problem of Internal and Edge Cracks in Multi-Layered Woven GFRP Laminates at Cryogenic Temperatures 248
T. Takeda, Y. Shindo, and F. Narita

NON-METALLIC MATERIALS — INSULATION

Development of Pre-Preg Ceramic Insulation for Superconducting Magnets 259
D. E. Codell and P. E. Fabian
Development of an Innovative Insulation for Nb_3Sn Wind and React Coils 266
A. Puigsegur, F. Rondeaux, E. Prouzet, and K. Samoogabalan
A Sol-Gel Approach to the Insulation of Rutherford Cables 273
F. Buta, Y. Hascicek, M. D. Sumption, L. Arda, Z. Aslanoglu, Y. Akin, and E. W. Collings

Performance of Magnet Insulation Systems at Low Temperature and After Reactor Irradiation 281
K. Bittner-Rohrhofer, K. Humer, H. Fillunger, R. K. Maix, and H. W. Weber
Low Temperature Mechanical Properties of Cyanate Ester Insulation Systems after Irradiation 289
P. E. Fabian, N. A. Munshi, S. W. Feucht, K. Bittner-Rohrhofer, K. Humer, and H. W. Weber
Mechanical and Thermal Characteristics of Insulation Materials for the KSTAR Magnet System at Cryogenic Temperature 297
W. Chung, B. Lim, M. Kim, H. Park, K. Kim, Y. Chu, and S. Lee

PART B

Nb-Ti CONDUCTORS

Flux Pinning Properties in Nb-Ti Composites Having Nb and Ti Mixed Artificial Pins 307
O. Miura, D. Ito, P. J. Lee, and D. C. Larbalestier
Development of Point-Array APC Nano-Structures in Nb-Ti Based Superconducting Strand 314
P. J. Lee, L. Motowidlo, M. Rudziak, and T. Wong
Comparison of the Properties and Microstructure of Niobium-47Titanium Superconductors with Magnetic and Non-Magnetic Island Pinning Centers 322
L. R. Motowidlo, M. K. Rudziak, T. Wong, L. D. Cooley, and P. J. Lee
Multifilament Superconducting Wire Based on NbTi Alloy in a Combined Copper/Copper-Nickel Matrix 330
G. P. Vedernikov, A. K. Shikov, L. V. Potanina, I. N. Gubkin, O. V. Scherbakova, N. I. Salunin, V. U. Korpusov, S. I. Novikov, and M. S. Novikov
Variable-Temperature Critical-Current Measurements on a Nb-Ti Wire 338
L. F. Goodrich and T. C. Stauffer

Nb_3Sn CONDUCTORS

A New Generation Nb_3Sn Wire, and the Prospects for its Use in Particle Accelerators 349
R. M. Scanlan, D. R. Dietderich, and S. A. Gourlay
Lessons Learned on the Development and Manufacture of Internal-Tin Nb_3Sn Strand from Work on ITER CSMC and Other Fusion and HEP Applications 359
E. Gregory
Nb_3Sn Conductor Development for Fusion and Particle Accelerator Applications 369
J. A. Parrell, M. B. Field, Y. Zhang, and S. Hong