

CONTENTS

Foreword	xv
Best Paper Awards	xvii
International Cryogenic Materials Conference Board	xix
Acknowledgment	xix

GENERAL REVIEWS

LOW-TEMPERATURE MATERIALS RESEARCH: A HISTORICAL PERSPECTIVE (Invited)

F. R. Fickett	1
-------------------------	---

MECHANICAL PROPERTY MEASUREMENTS AT LOW TEMPERATURES (Invited)

D. T. Read and R. L. Tobler	17
---------------------------------------	----

RECENT DEVELOPMENTS IN FILAMENTARY COMPOUND SUPERCONDUCTORS (Invited)

K. Tachikawa	29
------------------------	----

POWDER METALLURGY PROCESSES - A REVIEW OF THE STATUS AND PROMISE (Invited)

S. Foner	41
--------------------	----

STRUCTURAL ALLOYS

DEFORMATION OF METASTABLE AUSTENITIC STEELS AT LOW TEMPERATURES

R. P. Reed and R. L. Tobler	49
---------------------------------------	----

DISCONTINUOUS DEFORMATION MODES OF A NITROGEN-STABILIZED AUSTENITIC STEEL

B. Obst and D. Pattanayak	57
-------------------------------------	----

Contents

THE INFLUENCE OF MAGNETIC STRUCTURE ON TEMPERATURE DEPENDENCE OF THE YIELD STRENGTH OF 20Cr-16Ni-6Mn STEEL AT VERY LOW TEMPERATURES K. A. Yushchenko, B. I. Verkin, V. Ya. Illichev, and I. N. Klimenko	67
MECHANICAL EVALUATION OF NITROGEN-STRENGTHENED STAINLESS STEELS AT 4 K Y. Takahashi, K. Yoshida, M. Shimada, E. Tada, R. Miura, and S. Shimamoto	73
TENSILE AND FRACTURE PROPERTIES OF MANGANESE-MODIFIED AISI 304 TYPE STAINLESS STEEL R. L. Tobler and R. P. Reed	83
MECHANICAL PROPERTIES OF HIGH MANGANESE STEELS AT CRYOGENIC TEMPERATURES T. Horiuchi, R. Ogawa, M. Shimada, S. Tone, M. Yamaga, and Y. Kasamatsu	93
HIGH-ALLOY MANGANESE-ALUMINUM STEELS FOR CRYOGENIC APPLICATIONS J. Charles, A. Lutts, and A. Berghezan	105
PROPERTIES OF LOW-CARBON 25Mn-5Cr-1Ni AUSTENITIC STEEL FOR CRYOGENIC USE H. Yoshimura, H. Masumoto, and T. Inoue	115
CRACK INITIATION AND ARREST CHARACTERISTICS OF 9%Ni STEELS WITH VARIOUS CHARPY V-NOTCH ENERGY VALUES Y. Nakano, S. Suzuki, A. Kamada, and K. Hirose	127
THE USE OF LOW-TEMPERATURE STRENGTHENING OF STEELS IN WELDED CRYOGENIC STRUCTURAL CODES K. A. Yushchenko and S. A. Voronin	137
 NONMETALLICS AND COMPOSITES	
A REVIEW OF THE EFFECTS OF IONISING RADIATION ON PLASTIC MATERIALS AT LOW TEMPERATURES (Invited) D. Evans and J. T. Morgan	147
MECHANICAL PERFORMANCE OF GRAPHITE- AND ARAMID-REINFORCED COMPOSITES AT CRYOGENIC TEMPERATURES M. B. Kasen	165

REINFORCED POLYMERS AT LOW TEMPERATURES (Invited)	
G. Hartwig	179
DEGRADATION OF FIBER-REINFORCED COMPOSITE MATERIALS AT CRYOGENIC TEMPERATURES, PART I - UNIAXIAL TENSILE AND PURE TORSIONAL FATIGUE	
S. S. Wang and E. S.-M. Chim	191
DEGRADATION OF FIBER-REINFORCED COMPOSITE MATERIALS AT CRYOGENIC TEMPERATURES, PART II - MULTIAXIAL FATIGUE	
S. S. Wang and E. S.-M. Chim	201
CHARACTERIZATION OF GLASS-REINFORCED COMPOSITES FOR CRYOGENIC APPLICATIONS (Invited)	
J. V. Gauchel, J. L. Olinger, and D. C. Lupton	211
MECHANICAL PROPERTIES OF AN INSULATOR FOR THE JAPANESE LCT COIL	
K. Koizumi, K. Yoshida, E. Tada, M. Nishi, S. Shimamoto, M. Nagai, Y. Kadotani, and N. Tada	223
THE MANUFACTURE AND PROPERTIES OF RADIATION RESISTANT LAMINATES (Invited)	
J. R. Benzinger	231
MECHANICAL AND THERMAL PROPERTIES OF GLASS-FIBER-REINFORCED COMPOSITES AT CRYOGENIC TEMPERATURES	
A. Khalil and K. S. Han	243
COMPRESSIVE TESTS OF COMPOSITE TUBES AT 300 K AND 77 K	
K. S. Han, R. A. Peterson, and R. E. Rowlands	253
IMPACT TESTS OF REINFORCED PLASTICS AT LOW TEMPERATURES	
S. Nishijima, M. Takeno, T. Okada, and S. Namba	261
CURRENT STATUS OF STANDARDIZED NONMETALLIC CRYOGENIC LAMINATES	
M. B. Kasen and R. E. Schramm	271
CONCRETE: COMPRESSIVE PROPERTIES, FLEXURAL AND SPLITTING STRENGTHS, AND K_{Ic} AT LOW TEMPERATURES	
J. M. Arvidson	279
TENSILE, COMPRESSIVE, AND SHEAR PROPERTIES OF POLYURETHANE FOAM AT LOW TEMPERATURES	
J. M. Arvidson and L. L. Sparks	289
CRYOGENIC TESTS OF GLASS-EPOXY-BASED ELECTRICAL INSULATION	
J. D. Taylor, P. S. Martin, M. Pripstein, and M. A. Green	299

FLUX PINNING IN SUPERCONDUCTORS

FLUX PINNING IN HIGH-CURRENT-CARRYING SUPERCONDUCTORS (Invited)	
E. J. Kramer	307
FLUX PINNING FOR <u>IN SITU</u> PREPARED SUPERCONDUCTING COMPOSITES	
J. J. Sue, D. K. Finnemore, J. E. Ostenson, E. D. Gibson, and J. D. Verhoeven	323
NEUTRON IRRADIATION OF NbTi WITH DIFFERENT FLUX PINNING STRUCTURES	
H. W. Weber, F. Nardai, C. Schwinghammer, and R. K. Maix	329
ALPHA-TITANIUM PRECIPITATION IN NIOBIUM-TITANIUM ALLOYS	
A. W. West and D. C. Larbalestier	337

HIGH-FIELD SUPERCONDUCTORS

NEW PERSPECTIVES ON THE PHYSICS OF HIGH-FIELD SUPERCONDUCTORS (Invited)	
M. R. Beasley	345
THE PHASE RELATIONSHIPS IN Nb_3Sn WIRES AT LOW TEMPERATURES AS DETECTED BY CRYSTALLOGRAPHICAL (NEUTRON AND X-RAY DIFFRACTION) AND BY PHYSICAL [$B_{c2}(T)$, J_c vs. ϵ] MEASUREMENTS	
R. Flükiger, W. Schauer, W. Specking, L. Oddi, L. Pintschovius, W. Müllner, and B. Lachal	361
LOW TEMPERATURE STRUCTURAL TRANSFORMATIONS IN POWDERED SAMPLES OF Nb_3Sn	
H. W. King and D. W. Penfold	371
SUPERCONDUCTING PROPERTIES OF $(\text{Nb},\text{Ti})_3\text{Sn}$ WIRES FABRICATED BY THE BRONZE PROCESS	
M. Suenaga, S. Okuda, R. Sabatini, K. Itoh, and T. S. Luhman	379
EFFECTS OF THE IVa ELEMENT ADDITIONS ON COMPOSITE-PROCESSED Nb_3Sn	
K. Tachikawa, T. Takeuchi, T. Asano, Y. Iijima, and H. Sekine	389

A15 SUPERCONDUCTORS

PHASE RELATIONSHIPS, BASIC METALLURGY, AND SUPERCONDUCTING PROPERTIES OF Nb_3Sn AND RELATED COMPOUNDS (Invited) R. Flükiger	399
THE LAYER THICKNESS DEPENDENCE OF THE TRANSITION TEMPERATURE IN NIOBIUM-TIN D. B. Smathers and D. C. Larbalestier	415
SUPERCONDUCTING CURRENT DENSITIES IN BRONZE-PROCESSED Nb_3Sn MULTIFILAMENTARY WIRES S. Okuda, M. Suenaga, and T. S. Luhman	425
AN INVESTIGATION OF THE ENHANCEMENT OF THE CRITICAL CURRENT DENSITIES IN BRONZE-PROCESSED Nb_3Sn M. Hong, I. W. Wu, J. W. Morris, Jr., W. Gilbert, W. V. Hassenzahl, and C. Taylor	435
THE PROPERTIES OF MULTIFILAMENTARY WIRES ON Nb_3Sn BASE PREPARED BY THE HYDROEXTRUSION METHOD A. A. Galkin, V. P. Buryak, N. I. Matrosov, A. B. Dugadko, B. A. Shevchenko, L. A. Dereza, G. A. Korneeva, O. N. Mironova, V. M. Pan, V. S. Flis, Yu. I. Beletsky, M. I. Tsypin, L. A. Malysheva, and T. D. Manchenkova	445
EFFECTS OF TERNARY ADDITIONS ON YOUNG'S MODULUS AND THE MARTENSITIC TRANSFORMATION OF Nb_3Sn J. F. Bussière, B. Faucher, C. L. Snead, Jr., and M. Suenaga	453
MULTIFILAMENTARY Nb-Hf/Cu-Sn-Ga COMPOSITE WIRES K. Kamata, K. Aihara, H. Sekine, and K. Tachikawa	461
FORMATION OF MULTIFILAMENTARY V_3Ga WITH V-5 TO -7 ATOMIC PERCENT Ga ALLOYS C. R. Spencer, E. Adam, E. Gregory, F. T. Ormand, and D. G. Howe	471
DEVELOPMENTAL STUDIES ON POWDER-PROCESSED Nb_3Al SUPERCONDUCTING WIRE J. M. Hong, J. T. Holthuis, I. W. Wu, M. Hong, and J. W. Morris, Jr.	483

MULTIPLY-CONNECTED SUPERCONDUCTORS

OPTIMIZATION OF CRITICAL CURRENTS IN Cu-Nb ₃ Sn MICROCOMPOSITES	J. Wecker, K. Mrowiec, R. Bormann, and H. C. Freyhardt	495
ON THE OPTIMIZATION OF <u>IN SITU</u> Nb ₃ Sn WIRE	J. J. Sue, J. D. Verhoeven, E. D. Gibson, J. E. Ostenson, and D. K. Finnemore	501
TEMPERATURE DEPENDENCE OF J _C FOR <u>IN SITU</u> SUPERCONDUCTORS	J. E. Ostenson, D. K. Finnemore, J. J. Sue, E. D. Gibson, and J. D. Verhoeven	511
HIGH-FIELD CRITICAL CURRENT AND MECHANICAL PROPERTIES OF <u>IN SITU</u> PROCESSED V ₃ Ga SUPERCONDUCTORS	H. Kumakura, K. Togano, and K. Tachikawa	515
DEVELOPMENT OF CRYOSTABILIZED Nb ₃ Sn-Cu SUPERCONDUCTING WIRE USING THE <u>IN SITU</u> PROCESS	E. D. Gibson, J. E. Ostenson, J. J. Sue, J. D. Verhoeven, and D. K. Finnemore	525
TESTING RESULTS OF MULTIFILAMENTARY Nb ₃ Sn COMPOSITES MADE BY A MODIFIED JELLYROLL METHOD	S. S. Shen and W. K. McDonald	535
HYDROSTATIC EXTRUSION OF <u>IN SITU</u> PROCESS SUPERCONDUCTIVE WIRE FOR USE IN NMR MAGNETS	D. W. Hazelton, R. E. Schwall, B. Avitzur, and J. D. Verhoeven	545
FABRICATION OF STABILIZED <u>IN SITU</u> Nb ₃ Sn WIRE BY CONSUMABLE ARC MELTING AND ITS MAGNETIC BEHAVIOR	K. Yasohama, H. Ohkubo, T. Ogasawara, and Y. Yasukochi	555
CONTINUOUS HIGH TEMPERATURE GRADIENT SOLIDIFICATION OF <u>IN SITU</u> Cu-Nb ALLOYS FOR LARGE-SCALE DEVELOPMENT	H. LeHuy, J. L. Fihey, R. Roberge, and S. Foner	563

SUPERCONDUCTOR PROPERTIES AND MEASUREMENTS

EFFECT OF TWIST PITCH ON SHORT-SAMPLE V-I CHARACTERISTICS OF MULTIFILAMENTARY SUPERCONDUCTORS	L. F. Goodrich, J. W. Ekin, and F. R. Fickett	571
--	---	-----

END EFFECTS ON THE LOSS FOR SHORT SUPERCONDUCTORS W. J. Carr, Jr.	581
TWO-DIMENSIONAL ANALYSIS OF AC LOSS IN SUPERCONDUCTORS CARRYING TRANSPORT CURRENT J. V. Minervini	587
THE SPECIFIC HEAT OF NbTi FROM 0 TO 7 T BETWEEN 4.2 AND 20 K S. A. Elrod, J. R. Miller, and L. Dresner	601
FIELD EMISSION AND SECONDARY ELECTRON EMISSION FROM Nb ₃ Sn SURFACES G. Arnolds-Mayer and N. Hilleret	611
INVESTIGATION ON THE PHYSICAL MECHANISM UNDERLYING THE FUNCTION OF A FAST GOLD-TIN METAL FILM SECOND-SOUND DETECTOR H. Borner, T. Schmeling, and D. W. Schmidt	623
EFFECT OF THE DIFFUSION BARRIER ON THE MAGNETIC PROPERTIES OF PRACTICAL Nb ₃ Sn COMPOSITES S. S. Shen	633

STRAIN EFFECTS IN SUPERCONDUCTORS

STRAIN TOLERANCES IN Nb ₃ Sn CONDUCTORS T. Luhman	639
ON THE INTERACTION OF STRESS WITH THE MARTENSITIC PHASE TRANSITION IN Al5 COMPOUNDS D. O. Welch	655
THE EFFECT OF HIGH COMPRESSIVE STRESS ON THE CRITICAL CURRENT IN MULTISTRAND Nb ₃ Sn CONDUCTORS W. Hassenzahl, M. Hong, D. R. Dietderich, C. Taylor, W. Gilbert, and R. Scanlan	663
EXPERIMENTAL TEST OF STRESS SCALING LAW IN SUPERCONDUCTING V AND Nb M. Fukumoto, M. Kawamura, and T. Okada	671
SUPERCONDUCTING AND MECHANICAL PROPERTIES OF COLD HYDROSTATICALLY EXTRUDED MONOFILAMENTARY Nb ₃ Sn WIRES V. Thadani, T. S. Luhman, B. Avitzur, and Y. T. Chou	681

SUPERCONDUCTOR PERFORMANCE

RECENT DEVELOPMENTS ON METHODS FOR SUPERCONDUCTOR JOINING R. D. Blaugher	689
ELECTRICAL BOUNDARY RESISTANCE IN AN ALUMINUM-STABILIZED SUPERCONDUCTOR D. Yu, Y. M. Eyssa, and P. Zolliker	701
STRUCTURAL ASPECTS OF CABLE CONDUCTORS IN HIGH-FIELD- STRENGTH, HIGH-CURRENT-DENSITY SUPERCONDUCTING DIPOLES Z. J. J. Stekly	711
TRAINING STUDIES OF EPOXY-IMPREGNATED SUPERCONDUCTOR WINDINGS J. W. Ekin, E. S. Pittman, M. J. Superczynski, and D. J. Waltman	719
STABILITY MEASUREMENTS OF ALUMINUM-STABILIZED Nb-Ti BRONZE MATRIX Nb ₃ Sn POTTED SUPERCONDUCTING MAGNETS D. J. Waltman, F. E. McDonald, and M. J. Superczynski . .	729
TRANSIENT PERFORMANCE OF A PREREACTED, FULLY IMPREGNATED MULTIFILAMENTARY Nb ₃ Sn COIL B. B. Gamble, T. E. Laskaris, and T. A. Keim	739

FABRICATION - SUPERCONDUCTORS

THE TRIALS AND TRIBULATIONS OF FABRICATING THE PIPE FOR THE "ROPE IN A PIPE" Nb ₃ Sn SUPERCONDUCTOR P. Sanger, E. Adam, G. Grabinsky, E. Gregory, E. Ioriatti, and G. Rothschild	751
EVALUATION OF CONDUCTOR SHEATH ALLOYS FOR A FORCED-FLOW Nb ₃ Sn SUPERCONDUCTING MAGNET COIL FOR THE LARGE COIL PROGRAM (Invited) R. E. Gold, W. A. Logsdon, G. E. Grotke, and B. Lustman	759
CRYOGENIC TENSILE AND FRACTURE TOUGHNESS PROPERTIES OF THREE CANDIDATE STRUCTURAL MATERIALS FOR THE LARGE COIL PROGRAM SUPERCONDUCTING MAGNET CONDUCTOR SHEATH (Invited) W. A. Logsdon, G. E. Grotke, R. E. Gold, and B. Lustman	771
MECHANICAL PROPERTIES OF THE JAPANESE LCT COIL CONDUCTOR K. Yoshida, Y. Takahashi, E. Tada, M. Shimada, A. Tokuchi, N. Tada, and S. Shimamoto	781

THE FABRICATION AND PROPERTIES OF MULTIFILAMENTARY Nb ₃ Sn SUPERCONDUCTORS BY THE SOLID-LIQUID DIFFUSION METHOD M. Nagata, S. Okuda, M. Kawashima, M. Yokota, K. Ohkura, M. Watanabe, Y. Kimura, M. Umeda, H. Yamasaki, and Y. Akiyama	791
LONG-LENGTH Nb ₃ Sn TUBULAR CURRENT-CARRYING ELEMENTS FOR AN AC SUPERCONDUCTING CABLE V. M. Pan, G. A. Klimenko, Yu. I. Beletsky, and V. S. Flis	797
FABRICATION AND PERFORMANCE OF AN ALUMINUM-STABILIZED COMPOSITE SUPERCONDUCTOR K. T. Hartwig, P. Zolliker, D. Yu, S. W. Van Sciver, and A. Khalil	805
DEVELOPMENT OF AN INTERNALLY STRENGTHENED Nb ₃ Sn CONDUCTOR C. R. Spencer, E. Adam, and E. Gregory	815
CUPROUS SULFIDE AS A FILM INSULATION FOR SUPERCONDUCTORS G. R. Wagner, P. D. Vecchio, and J. H. Uphoff	821
 FABRICATION - STRUCTURAL ALLOYS AND COMPOSITES	
WELDABLE STRUCTURAL STEELS FOR ROTORS OF CRYOGENERATORS K. A. Yushchenko, V. I. Belotzerkovetz, O. G. Kvasnevskii, and A. V. Shavel	833
SHIELDED METAL-ARC AND FLUX-CORED METAL-ARC STAINLESS STEEL WELDMENTS: MAGNET CASES FOR 4-K SERVICE E. N. C. Dalder, O. W. Seth, and T. A. Whipple	839
USE OF HEAVY SECTION AUSTENITIC WELDS FOR 4-K SERVICE (Invited) A. Nyilas and H. Krauth	853
WELDING OF AUSTENITIC STAINLESS STEEL FOR 4-K SERVICE (Invited) F. R. Schneider, Jr.	865
FERRITIC WELDMENT OF GRAIN-REFINED FERRITIC STEELS FOR CRYOGENIC SERVICE H. J. Kim, C. K. Syn, and J. W. Morris, Jr.	873
DEVELOPMENT OF FORGING AND HEAT TREATING PRACTICES FOR AMS 5737 FOR USE AT LIQUID HELIUM TEMPERATURES E. N. C. Dalder and M. Greenlee	883

INDEXES

Author Index	915
Material Index	919
Subject Index	921

