

Contents

- XI Ukrainian Organizing Committee
- XII Sponsors
- XIII International Cryogenic Engineering Committee
- XIV International Cryogenic Materials Committee
- XV Foreword

Cryogenic systems

Small refrigerators and cryocoolers

- 1 Application concepts of small regenerative cryocoolers in superconducting magnet systems
M.T.G. van der Laan, R.B. Tax and H.H.J. ten Kate
- 5 Investigation on a two-stage Solvay refrigerator with magnetic material regenerator
G. Chen, J. Zheng, F. Zhang, J. Yu, Z. Tao, C. Ding, L. Zhang, P. Wu and Y. Long
- 9 Experimental study and modelisation of a pulse tube refrigerator
A. Ravex, P. Rolland and J. Liang
- 13 Miniature Joule-Thomson liquefier with sintered heat exchanger
E. Bodio, M. Chorowski, M. Wilczek and A. Bozek
- 17 The miniature Joule-Thomson refrigerator
E. Mikulin, J. Shevich, T. Danilenko, N. Solovov and V. Veselov
- 20 The self-regulating effect used in Joule-Thomson microcryogenic systems
Y.I. Landa, L.G. Kelarev, V.G. Dengin and L.G. Abakumov
- 24 Experimental results of the internal process of a double inlet pulse tube refrigerator
B. Zhou, P. Wu, S. Hu and G. Chen
- 28 Electrocaloric refrigeration: investigation of a model and prognosis of mass and efficiency indexes
Yu.V. Sinyavsky, G.E. Lugansky and N.D. Pashkov
- 32 Behavior of the gas temperature and pressure in the pulse tube refrigerator
M. Tanaka, S. Kawamatsu, T. Kodama, T. Nishitani, E. Kawaguchi and M. Yanai
- 36 Application of high T_c superconducting materials in cryogenic Peltier coolers
A.B. Mosolov and N.A. Sidorenko
- 40 Thermoelectric materials for Peltier cryogenic coolers
N.A. Sidorenko

Large refrigerators and their components

- 44 Refrigeration of large scale superconducting systems for high energy accelerators
G. Horlitz
- 52 Closed cycle liquid helium refrigerators
G. Claudet, R. Lagnier and A. Ravex
- 56 A 2 kW He refrigerator for sc magnet tests down to 3.3 K
F. Spath, R. Heil, J. Lesser, H. Schimmer, J. Weber, A. Gray and U. Wagner
- 60 Design of a 8-kW refrigeration system for ITER common test
T. Kato, H. Ebisu, T. Hiyama, K. Kawano, M. Sugimoto, S. Iwamoto, A. Miyake and H. Tsuji

- 64 Refrigerator for experimentation on superfluid helium
F. Yuri, B. Vladimir, M. Valeri and S. Oleg
- 68 Part load, mixed duty and 1.8 K operation with a new high efficient helium refrigeration cycle
H. Quack, U. Wagner, L. Decker, K. Löhlein and B. Ziegler
- 72 Design, commissioning and operating experience of the PSI KA-IV multipurpose helium refrigerator
M. Amstutz, H.U. Baumann, R. Clerc, W. Gloor, K. Kurtcuoglu, K. Löhlein, R.M. Schulze, J.A. Zichy and B. Ziegler
- 76 Experimental study of three-titling-pad self-acting journal gas bearing expansion turbine
C. Chen, Z. Dong, G. Cui, Y. Wu, R. Tang and G. Liu
- 80 Development of cryogenic turboexpanders with gas dynamic foil bearings
I.A. Davydenkov, Yu.A. Ravikovich, A.B. Davydov, Yu.I. Ermilov, N.E. Zakharova, Yu.R. Adler and S.I. Shchedukhin
- 84 Hydrogen and nitrogen turboexpanders with high gas expansion ratios
I.A. Davydenkov, A.B. Davydov and G.A. Perestoronin
- 87 High power industrial gas bearing cryogenic expansion turbines
G.M. Gistau and J.C. Villard
- 91 The influence of the diagram design and the main parameters on the efficiency of helium liquefaction and refrigeration plants
G.B. Narinsky and L.V. Chernokov
- 96 Built-in cryogenic control fixtures with electric drive
E.A. Kaklyugin and I.A. Davydenkov
- 100 Test of three different pumps for circulating He I and He II
G. Zahn, A. Hofmann, H. Bayer, H. Berndt, R. Doll, W. Herz, M. Süßer, E. Turnwald, B. Vogeley and W. Wiedemann
- 104 A special type of carbon temperature sensors used in the 6.4 km long superconducting proton ring HERA
T. Beijvoets, U. Knopf, H. Lierl and H.C. Meijer

Cryogenic loops, components and liquids

- 109 Cryogenic needs for future tokamaks
H. Katheder
- 118 Design concept and first experimental validation of the superfluid helium system for the Large Hadron Collider (LHC) project at CERN
J. Casas, A. Cyvoct, P. Lebrun, M. Marquet, L. Taviani and R. van Weelderden
- 122 The large cryogenic helium systems for superconducting magnets
I.K. Butkevich
- 126 Helium cooling for large superconducting physics detector magnets
M.A. Green
- 130 Parallel operation of cryogenic units with a single steady-state operated device
I.K. Butkevitch, A.N. Kostrov, N.A. Purtov and V.Ph. Romanishin
- 134 Operation of a forced flow superfluid helium test facility and first results
B. Rousset, G. Claudet, A. Gauthier, P. Seyfert, P. Lebrun, M. Marquet, R. van Weelderden and J.-L. Duchateau
- 138 Construction and installation of the SSC Accelerator System String Test cryogenic systems
T. Ankermann, M. Freeman and T. Kobel
- 142 The Tore Supra, flexible and electrically insulating, cryogenic connection line
G. Bon Mardion, B. Gravit and B. Jager
- 146 Long-term operational experience and upgrade of the cryogenic system for the superconducting cavities in the CERN SPS accelerator
G. Passardi, N. Delruelle, A. Juillerat and J. Tischhauser

- 151 Status of cryogenics for the LEP200 energy upgrade project at CERN
M. Barranco-Luque, S. Claudet, W.K. Erdt, P.K. Frandsen, Ph. Gayet, D. Güsewell, K.P. Hoffmann, J. Schmid, N. Solheim, G. Winkler and C. Wyss
- 155 On cryopumps for selective pumping of "Globus" tokamak
V.B. Yuferov, S.F. Grishin, V.O. Ilyicheva, N.A. Kosik, Yu.V. Kholod, L.G. Sorokovoj, G.M. Vorobjev and A.N. Novokhatskij
- 159 The manufacture of a cryogenic silicon diode thermometer and its application in a temperature controlling system
Y. Wu, Z. Tie, L. Chen, D. Yang and Y. Ling
- 163 Experimental study of the safety valve for superconducting magnets of the UNK
M.V. Levin, V.V. Pleskach and S.E. Salimov
- 167 Calculational and theoretical study of air separation plants for simultaneous production of gaseous and liquid products
G.B. Narinsky
- 173 Low temperature adsorptive hydrogen isotope separation
G.G. Zhun, V.F. Getmanets and V.P. Maletskii
- 175 Possibilities of ecological production of methane from mixtures of ethane and carbon dioxide
R. Agsten and F.X. Eder

Cryostat technology

- 179 Newly designed cryostat for the ALPI Linac
P. Favaron, R. Pengo and S. Gambalunga
- 183 Continuous-flow helium cryostat for electron irradiation
V.L. Arbuzov and A.E. Davletshin
- 187 He³ cryostat
L.G. Novichkova, Yu.V. Kulikov and N.M. Stashkova
- 191 Design of LHC prototype dipole cryostats
J.-C. Brunet, J. Kerby, Ph. Lebrun, P. Rohmig, B. Szeless and L.R. Williams
- 195 Research and development of thermal shield support under radiation environment in large helical device
S. Nishijima, T. Okada, M. Kanamaru and J. Yamamoto
- 199 High efficiency small cryovessels
G.G. Zhun, V.F. Getmanets, R.S. Mikhalchenko, V.V. Sutula and A.G. Podolski
- 203 Experimental complex of the non-magnetic radiotransparent cryostatting system
V.T. Arkhipov, V.F. Getmanets, A.Ya. Levin, N.M. Levchenko, R.S. Mikhalchenko, V.F. Papakin and V.V. Shapovalenko
- 207 Dilution refrigerator with condensation pumping
V.E. Sivokon, V.V. Dotsenko, L.A. Pogorelov and V.I. Sobolev
- 211 Dynamic and static characteristics of adsorption pumps for dilution refrigerator
V.N. Grigor'ev and R.I. Shcherbachenko
- 215 Precision heat inleak measurements on cryogenic components at 80 K, 4.2 K and 1.8 K
H. Danielsson, P. Lebrun and J.-M. Rieubland
- 219 Simulation and calculation of temperature and pressure during non-drained storage of cryogenic liquids
Y.A. Kirichenko and J.A. Suprunova
- 223 New equipment for calorimetric measurement of AC losses in superconducting samples
E.N. Aksenova and P.V. Aksenov
- 226 Cryogenic thermometry for space testing systems
R. Blanpain, C. Jamar, J.-P. Macau and A. Cucchiari
- 229 Design of pressurized coil of the small medical Dewar
R. Wang, A. Gu and S. Hu

Heat transfer problems

- 233 Calculation of critical heat flux at boiling under natural and forced convection conditions
V.V. Budrik
- 237 Transient subcritical and supercritical helium heat transfer in an open bath and gaps
V.I. Deev, V.S. Kharitonov, A.N. Savin and K.V. Kutsenko
- 241 Calculating model for critical heat flux and dynamical characteristics of film boiling regime development at transient heat generation on nonisothermal surfaces in cryogenic liquids
A. Pavlenko, I. Starodubtseva and V. Chekhovich
- 245 Heat transfer and boundaries of its regimes during hydrogen boiling at different metallic surfaces
S.M. Kozlov and S.V. Nozdrin
- 249 The experimental study of liquid nitrogen boiling heat transfer in vertical narrow channel of porous layer surface
R. Wang, Y. Li, A. Gu and S. Hu
- 253 He-II-vapour interface stability at high heat fluxes
K.A. Briantsev and V.U. Sidyganov
- 256 Dynamics of heat transfer in HeI and HeII at repetitive pulse heat load input
Y. Filippov, V. Minashkin and I. Sergeyev
- 260 Heat transfer characteristics of a plate-fin type supercritical/liquid helium heat exchanger
T. Kato, A. Miyake, T. Hiyama, K. Kawano, S. Iwamoto, H. Ebisu, T. Takahashi, K. Hamada, H. Tsuji, N. Tsukamoto, M. Yamaguchi, H. Ishida, T. Honda, A. Yamanishi, T. Ohmori and M. Mori
- 264 Performance of parallel flow HeII heat exchangers
Y. Huang, Y. Chang, R.J. Witt and S.W. Van Sciver
- 268 Heat transfer performance test of a prototype plate-fin condenser-boiler for industrial usage
Y. Wu, Y. Liu, L. Chen, Y. Li and H. Xie
- 272 Transient heat-induced convection of supercritical helium in the dipole magnet channels
V.I. Deev, I.G. Merinov, V.S. Kharitonov and V.V. Shako
- 276 Simple and reliable thermal anchor of electrical leads for low-temperature apparatus
E. Gažo and P. Skyba
- 279 Modelling and experimental investigation of transient heat transfer and hydrodynamics in LTSC and HTSC cables of ICCS type
Yu.M. Pavlov, I.V. Yakovlev, Yu.A. Terentiev and V.I. Antipov
- 283 Heat transport in cable in conduit conductors (CICC) cooled by He II
R. Maekawa
- 287 Heat transfer during liquid nitrogen boiling at the surface of $\text{YBa}_2\text{Cu}_3\text{O}_7\text{-Ag}$ composite with various volume Ag contents
S.M. Kozlov, K.V. Rusanov, E.G. Tyurina, V.I. Dotsenko and I.F. Kislyak
- 291 Transient heat transfer to liquid helium at a 100 Hz pulsed heat load
C. Schmidt
- 295 Thermal conductivity and electric resistance of composite wires based on HT-50
S.S. Kozub, Ya.A. Shpakovich and A.V. Zlobin
- 300 The threshold value of heat flux for thermosyphon microfilm heat transfer with the testing sample partially immersed in liquid nitrogen
Y. Wu, S. Peng, L. Chen and H. Xie
- 304 Acoustic, video and thermoacoustic registration of boiling up phenomena in He II
G. Stamm, M. V. Schwerdtner and A.N. Tsoi

- 308 Heat transfer in devices with solid cryogenes and its mathematical description
R.S. Mikhalchenko, V.T. Arkhipov, V.F. Getmanets, A.A. Dubrovin, E.N. Dubrovina and I.N. Ostrovski
- 312 The experimental research on the artificial activation of thermosyphon-microfilm two phase flow in liquid nitrogen
Y. Wu, D. Yang, L. Chen and H. Xie
- 316 The investigation of flow characteristics and heat transfer at the nitrogen natural circulation in capillary
D. Podkorytov, L. Timkin and V. Chechovich

Superconductivity technology

S.c. magnets and design problems

- 320 He II cooling of large superconducting magnet system
S.W. Van Sciver
- 328 Niobium-tin superconducting inductor for levitated vehicles
E.Yu. Klimenko, N.N. Martovetsky, A.M. Malofeev, V.A. Mokhnatuk, S.I. Novikov, N.M. Rodina, V.I. Omelyanenko, R.N. Pokhodenko and S.A. Sergeev
- 332 Superconducting dipole moment correction coils for a free-flying version of ASTROMAG
M.A. Green
- 336 The UCLA Phi Factory detector, the integration of superconducting compensation solenoids and the final focus interaction region quadrupoles
M.A. Green and D.B. Cline
- 340 Design concept of the (π - μ)-converter for the SINDRUM II spectrometer
J.A. Zichy, W. Djordjadze, C.B. Niebuhr, D. Renker, A. van der Schaaf and M. Werner
- 344 Superconducting final focus for the SLAC Linear Collider
W.W. Ash, F. Barrera, W. Burgess, K. Cook, H. Cutler, J. Ferrie, H. Petersen, D. Sawyer and R. Rinta
- 348 Reduction of the sextupole component in the dipole field of a superconducting bending magnet
A. Yamanishi, M. Yamaguchi, T. Ohmori and T. Taira
- 352 On calculation of 3-dimensional temperature fields and thermomechanical stresses in the UNK SC dipole under its cooldown
A.G. Abramov, A.I. Ageyev, A.B. Balyev, Yu.G. Bozhko, A.G. Daikovsky and A.V. Zhirnov
- 356 Investigation of thermal processes after quench in the superconducting coil with thermally insulated outer surface
V. Bolshakov, I. Kovalev, N. Kopeikin and S. Kruglov
- 361 Cryogenic materials aspects of the ITER superconducting magnet system
O.G. Filatov and A.I. Kostenko
- 369 Principles of material selection, evaluation of performance, design and technology of industrial production of the load-carrying structure of "ITER" superconducting magnetic system
K.A. Yushchenko, S.A. Voronin, G.G. Monko, A.E. Mokrenko, V.A. Glukhikh, O.G. Filatov, Yu.V. Yakubovskii, Yu.V. Spirchenko, R.V. Chvartatskii and Yu.V. Sobolev
- 376 Cryogenic compressive deformation properties of superconducting coil packs simulated for helical coils on LHD program
A. Nishimura, H. Tamura, T. Mito, K. Takahata, N. Yanagi, M. Sakamoto, S. Yamada and J. Yamamoto
- 380 On the influence of mechanical and magnetic characteristics on the field quality of superconducting magnets
A.G. Abramov, S.Yu. Ershov, A.G. Daikovsky, A.D. Ryabov and N.P. Tkachenko

- 384 Systems ensuring cryostability of superconducting magnets
N.N. Filina
- 390 Computer code for simulation of thermal processes during quench in superconducting magnets windings
A.V. Gavrilin
- 394 Influence of construction concepts on training behavior of gyrotron magnets
F. Chovanec, P. Ušák, J. Kokavec and L'. Krempaský
- 398 Current densities and quench currents in laboratory 50 Hz magnet
M. Polák, M. Majoroš, J. Pitel, J. Kokavec and L. Krempaský
- 402 Peculiarities of 2-D normal zone propagation in one-layer helical superconducting solenoid
A.V. Gavrilin and A.I. Rusinov
- 406 The use of internal shunts for quench protection
A.A. Konyukhov and V.A. Malginov
- 410 Influence of copper quality on overload performance of current leads
H. Köfler and F. Ramsauer
- 414 Optimization of a independently cooled cryogenic current lead
I.I. Samorodov and V.V. Filatov

Stability of superconductors

- 419 The stability margins of superconducting cables with two insulated strands
V.S. Vysotsky and V.N. Tsikhon
- 423 Quench energies of multistable composite superconductors
A.A. Pukhov
- 427 Normal zone propagation in the composite superconductor carrying varying transport current
A.A. Pukhov and A.L. Rakhmanov
- 431 The two-dimensional generalized analysis of thermal stability of composite superconductors
V.R. Romanovskii
- 435 The quench velocity in multifilament superconductor after fast current increasing
V.S. Vysotsky and V.N. Tsikhon
- 439 Interstrand coupling AC-losses in multistage cable-in-conduit superconductors
S.A. Egorov, A.Yu. Koretskij and E.R. Zapretilina
- 443 Direct solution approximation to the thermal hydraulic quenchback in superconducting cables
G. Lopex

Electrotechnical application of s.c.

- 447 NbTi foil thermally controlled switches for superconducting converters with operation frequency up to 50 Hz. Part 1: Experiment
O.A. Shevchenko, G.B.J. Mulder, N.V. Markovsky and H.H.J. ten Kate
- 451 NbTi thermally controlled switches for superconducting converters with operation frequency up to 50 Hz. Part 2: Theory and analysis
G.B.J. Mulder, O.A. Shevchenko, M.A. Fedorovsky and H.H.J. ten Kate
- 455 A superconducting hydrogen-cooled switch on Nb-Sn tape
A.V. Kupko, P.A. Kutsenko and B.K. Pryadkin
- 458 Quick response characteristics on a persistent-current-switch in a type of transformer
M. Takeo, S. Sato, K. Funaki and K. Kuroda
- 462 Development of 6.6kV/1.5kA-class superconducting fault current limiter
D. Ito, K. Tsurunaga, T. Tada, T. Hara, T. Ohkuma and T. Yamoto

- 466 The design of stable race-track superconducting switch
P. Ušák, F. Chovanec, B. Hanečka, J. Kokavec and L'. Krempaský
- 470 Compact superconducting power source constructed on base of the flux pump with heat switches
V.A. Rakhubovskij
- 473 The engineering method of superconducting rectifiers computation
I.B. Diak, O.A. Shevchenko, N.V. Markovsky and M.A. Fedorovsky
- 477 Engineering method of cooldown calculation for power transmission and magnet superconducting cables
M.B. Gorbounov, M. Valle and F. Vivaldi
- 481 Stability of fully superconducting and damperless generator by excitation control
J. Chen, O. Tsukamoto and S. Akita
- 485 Optimization of characteristics of the resonance motion transducer designed for large dynamic range instruments
V.A. Charkin
- 489 Electromagnetic properties of large capacity superconducting cables in a 1000 kVA-class superconducting transformer
K. Funaki, M. Iwakuma, M. Takeo, N. Takahashi, T. Fujii, T. Nakata, M. Hoshino, M. Shimada, E. Yoneda, T. Fujioka, T. Kumano, E. Suzuki and K. Yamafuji
- 493 Simulation of complex electric circuits with superconducting elements
O.A. Shevchenko, M.A. Fedorovsky, N.V. Markovsky, G.B.J. Mulder and H.H.J. ten Kate

S.c. detectors and electronics

- 497 Ultra low noise SIS-receivers for mm wave radio astronomy
S. Shitov, V. Koshelets, S. Kovtonyuk, A. Ermakov and A. Baryshev
- 501 Superconducting millimeter wave oscillators
V. Koshelets, A. Shchukin, S. Shitov and L. Filippenko
- 505 Multiloop integrated dc SQUID low noise RF amplifier
M. Tarasov, G. Prokopenko, V. Belitsky and L. Filippenko
- 509 Single flux quantum voltage amplifiers
V. Golomidov, V. Kaplunenko, M. Khabipov, V. Koshelets and O. Kaplunenko
- 513 A simple portable SQUID-based susceptometer
V.N. Trofimov
- 517 UHF SQUID-magnetometer at 77 K
V.P. Timofeev, S.S. Khvostov, G.M. Tsoi and V.I. Shnyrkov
- 521 Gravity radiometer with coupled superconducting suspensions
V.A. Charkin and A.E. Pischits
- 525 Superconducting gravity meter with a small-sized sensor
V.A. Charkin and A.E. Pischits
- 529 Algorithms of data processing for distributed multichannel SQUID-gradiometer system in the case of magnetic field source localization
M.A. Primin, V.I. Gumeniyuk-Sychevskiy and I.V. Nedayvoda
- 533 Bolometric characteristics of YBaCuO and LaSrCuO films
I.A. Khrebtov, M.B. Krayuhin, V.N. Leonov, A.D. Tkachenko, A.Yu. Klimov, D.G. Pavelyev and A.A. Ivanov
- 537 Detector system with cryogenic semiconductor and superconductor bolometers
I.A. Khrebtov, E.N. Lavrenova, V.G. Malyarov and A.D. Tkachenko
- 541 A high horizontal stiffness sensor as used in gravimetry
V.A. Charkin and A.E. Pischits
- 545 A hot wire anemometer for cryogenic hydrodynamic experiments
B. Castaing, B. Chabaud, B. Hébral and J. Peinke

- 549 Wide frequency band sampling system to test RSFQ logic
E.B. Goldobin, V.K. Kaplunenko, M.I. Khabipov and L.V. Filipenko
- 553 New design in RSFQ logic family
A.Yu. Kidiarova-Shevchenko and A.F. Kirichenko
- 558 Experimental implementation of the eight bit analog-to-digital converter
V. Kaplunenko, M. Khabipov, V. Koshelets, S. Kovtonyuk and D. Khohlov

Thin films and Josephson junctions

- 562 High-temperature Josephson junctions and their applications
A.I. Braginski
- 571 Development of results of weak link model named "josephson net"
V. Kuzminykh
- 575 High temperature superconducting thin film structures for electronic applications
M.E. Gershenson, M.I. Faley and J.E. Nevelskaya
- 579 Superconducting thin-films structures for Josephson junctions
I.D. Vojtovich, T.S. Lebedeva, S.Ja. Navala and V.A. Lobodjuk
- 583 Properties of multilayered Nb-based tunnel structures prepared with the whole-wafer process
I.P. Nevirkovets, H. Kohlstedt and C. Heiden
- 587 Epitaxial YBCO(F) films directly deposited on sapphire and its microwave properties
R. Young, K. Young, J.D. Budai, J.S. Martens, G. Venturini, M. Muller and S. Ovshinsky
- 592 Voltage-current characteristics and the resistive hotspot in thin Y-Ba-Cu-O films
A.Sh. Fix, I.L. Maksimov, K.V. Morozov and V.V. Osipov
- 596 LPE growth of high T_c $\text{Bi}_2\text{Sr}_2\text{Ca}_1\text{Cu}_2\text{O}_x$ films
A.S. Yue, S.H. Choi, H.J. Choi
- 600 Magnetic field behaviour of the instability currents in resistive state of wide films
V.A. Maltsev, A.V. Kulikovskiy and H.H. Erganokov
- 604 Critical current properties of HTSC thin films for applied purposes
N.T. Cherpak, A.A. Gippius, A. Gladun, H. Piel and D. Busch
- 608 Crystal structure of epitaxial YBCO films prepared on (001) MgO substrates at low oxygen partial pressures
A.P. Shapovalov, A.I. Ruban, Yu.M. Boguslavskij, G.G. Gridneva, V.S. Melnikov, N.P. Pshentsova and O.A. Turok
- 612 Numerical simulation of MOCVD-process for YBCO thin film fabrication in stagnation point reactor
S.E. Khoruzhnikov, A.M. Robachevsky and A.S. Segal
- 616 Magnetic properties of YBaCuO thick films prepared by LPE method
S. Barilo, V. Gataiskaya, A. Ges, P. Grizkov, L. Kurochkin and S. Kurochkin
- 620 The millimeter wave surface resistance measurements of Y-Ba-Cu-O films epitaxially grown on non-buffered sapphire substrates
O. Pustynnik, V. Vratskikh, S. Vasiljev, A. Dymnikov, I. Voinovsky and O. Khimenko
- 624 Preliminary study of working characteristics of film HTS switch in liquid nitrogen
N.V. Markovsky, O.A. Shevchenko, A.A. Shevchenko, B.I. Pavlus, V.S. Pan, V.S. Flis, S.K. Yushchenko and M.G. Vasilenko-Sheremetiev

628 **Author Index**