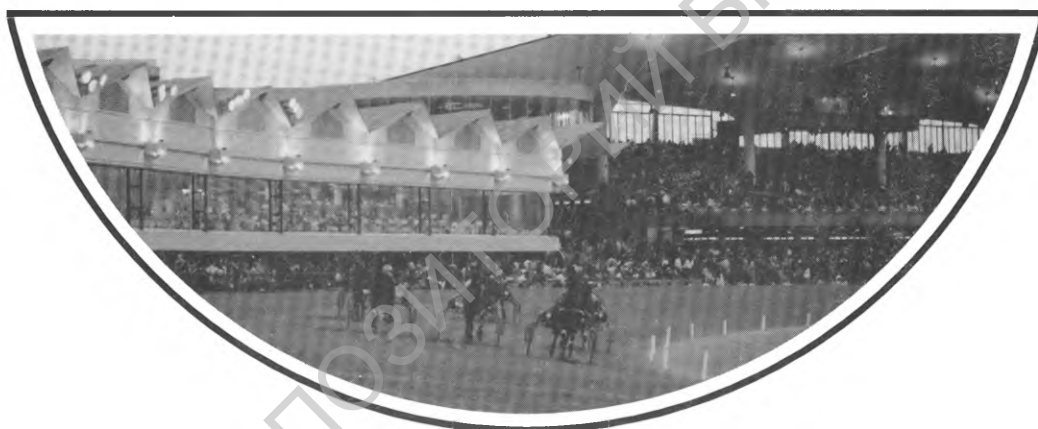




CEC/ICMC 1995



CONFERENCE ABSTRACTS

**Cryogenic Engineering Conference
and International Cryogenic
Materials Conference**

July 17- 21, 1995
Hyatt Regency Hotel / Columbus, Ohio USA

Conference Hosts:

*Battelle Memorial Institute
CVI
Lake Shore Cryotronics, Inc.*

TU-Z1-5

GALVANOMAGNETIC PROPERTIES OF COMPOSITE ALUMINUM HYPERCONDUCTORS, S.E.Demyanov, A.A.Droz, A.V.Petrov and M.L.Petrovskii, Institute of Physics of Solids & Semiconductors, P.Brovka Str.17, Minsk 220072, Belarus - We report investigations of field dependences of transverse magnetoresistance and Hall voltage in composite aluminum conductors, and analyses of the causes of anomalous effects observed in these materials earlier. The measurements were carried out on two specimens having an outer sheath of strength Al-Mg alloy and a single inner core of high pure aluminum, which RRR was 10000. Sheath of the first specimen has been slotted down to its core surface, so that leads could be attached to the core. For the second specimen leads were soldered on its sheath surface. We have not found any difference in field dependences and in magnetoresistance $\Delta R/R$ values for these two specimens. This curve first rises rapidly with the field and then leveled off with a slight linear rise, and at 7 T it reached $\Delta R/R$ value 4. With that, difference in $\Delta R/R$ values, measured on six leads pairs was no more than 10%. Hall voltage showed strict linear field dependence. Therefore, the presented results show the absence of any anomalous effect, at least in the studied composite specimens.

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TU-Z1-6

MAGNETOSENSITIVE CONDUCTIVITY OF ALUMINUM AND THE ADVANTAGE OF CORBINO GEOMETRY, B.B.Boiko, V.R.Sobol, O.N. Mazurenko, and A.A.Droz, Institute of Physics of Solids and Semiconductors, Academy of Sciences of Belarus, Minsk 220072 - Aluminum being uncompensated metal has a small magnetoresistance and this property is usually not used in magnetosensitive devices. On other hand in cylinder-like sample with current flow along the radius (Corbino geometry) the magnetoconductance is extremely small. Here the results of study of this phenomenon in Al disk-like samples are presented. The material had residual resistance ratio ~ 10000 , an external magnetic field was up to 8T, the current flow through the sample reached 1000A, the temperature of measurements was 4.2K. The magnitude of magnetoconductance and the value of the own magnetic field due to Hall current have been determined during the study. The magnetoconductance effect reached of 5000 and the value of the own magnetic field was up to 50% of applied magnetic field. Analysis of obtained data indicates that there are possibilities of using of these phenomena in cryogenic systems of control of electrical circuits where nonlinear resistance and inductance changing parametrically by the current, its direction and an external magnetic field are required. For nonstationary transition processes the analysis is given with account of high skin effect and the characteristic times and sizes are estimated. It is necessary to note that the advantages of high pure aluminum used in such manner may be utilized most fully because in massive conductors the ponderomotive forces are not too critical as in the thin bus-bar wires.

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TU-Z1-7

MAGNETOSTIMULATED INHOMOGENEITY OF ELECTRIC FIELD IN ALUMINUM, V.R.Sobol, O.N.Mazurenko, and A.A.Droz, Institute of Physics of Solids and Semiconductors, Academy of Sciences of Belarus, Minsk 220072 - The results of low temperature experimental and theoretical study of potential distribution of stationary electric field in Al under the action of inhomogeneous magnetic field are presented. The inhomogeneities along transport direction were modeled by the bending of rectangular samples in such manner that normal to the sample surface components of external transverse homogeneous field were changed in accordance with the given laws. Magnetic field was up to 8T and the degree of its inhomogeneity was varied from 5 to 35 % per cm. The law of change of transverse magnetic field was both linear and exponential. The analysis of the problem has been done on the basis of continue equation with the appropriate boundary conditions for approximation of quasi-isotropic dispersion law. The observed strong functional dependences of potential on coordinates are essentially different along the transport and normally to it. That may be used in some direct current devices of cryogenic electronics. For example in logarithmic attenuators with low resistance, different devices of matching of signal sources having high output resistance, logarithmic converters of current into voltage. Such devices may be organized in systems having steady magnetic field. They will be reliable as are simple constructions on the base of massive samples. The characteristics of such devices will be determined by the purity of material and the inhomogeneity of magnetic field.

The work is supported by the National Science Foundation of Belarus through Grant No F40-249.

SESSION TU-B1: Pulse Tube

Cryocoolers - I

Franklin A-B

Ch: R. Radebaugh CCh: P. Gifford

TU-B1-1

MINIATURIZATION OF A PULSE TUBE REFRIGERATOR WITH LINEAR MOTOR DRIVE COMPRESSOR,* C.Wang, J.H.Cai, Y.Zhou and W.X.Zhu, Cryogenic Laboratory, Chinese Academy of Science, Beijing 100080-In order to minimize a pulse tube refrigerator for practical use, a co-axial pulse tube refrigerator with linear motor drive compressor is designed and investigated. Its configuration is very similar to a split Stirling cryocooler. The effects of the heat transfer between the regenerator and the pulse tube for co-axial configuration are compared experimentally. The results show that the heat transfer retards the performance of the refrigerator. To improve the performance and reduce the size of the cold head, a co-axial pulse tube refrigerator with different lengths of the pulse tube and the regenerator is suggested in this paper. The diameter of the cold head of the tested refrigerator is only 8mm. The no load temperature below 100K is obtained with this co-axial pulse tube refrigerator.

*Research supported by the National Natural Science Foundation and Postdoctoral Science Foundation of China.

TU-B1-2

COOLING CHARACTERISTICS OF A MODIFIED MINIATURE PULSE TUBE REFRIGERATOR, T. Haruyama and H. Inoue, KEK, National Laboratory for High Energy Physics, Tsukuba, Ibaraki, 305, Japan - A cooling performance of a split type miniature pulse tube refrigerator with a flexure spring compressor was investigated. Only 7W of compressor driving power was required to get the lowest temperature of 176 K with no load. A double inlet valve worked effectively to get lower temperature, however, we found that the achieved lowest temperature was greatly depended upon the inside structure of the needle valve. An Oxford type compressor was driven at several different frequencies from 40 to 55 Hz with a swept volume around $\sim 1 \text{ cm}^3$. A diameter and a length of the miniature pulse tube were 5 mm and 60 mm, respectively. A stack of stainless steel mesh of #300 was used as a regenerator. The cooling characteristics of a modified configuration, such as double inlet with compressor back side volume as a reservoir, one compressor with another hot piston configuration etc., in order to investigate the dominant factor in a cooling performance of the miniature-size pulse tube refrigerator.