May 20 - 24, 1996

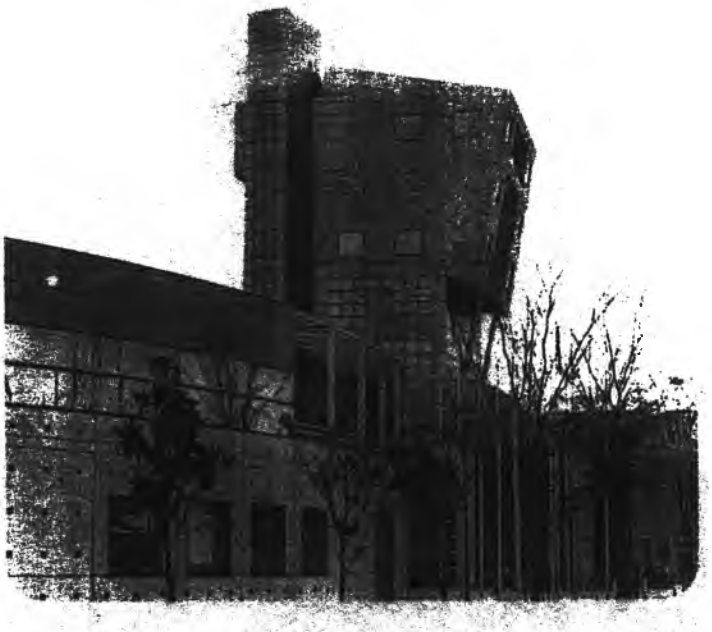
16th International Cryogenic Engineering Conference /
International Cryogenic Materials Conference and
Industrial Exhibition

Kitakyushu, Japan

第16 回国際低温工学会議／国際低温材料会議

ICEC16 / ICMC

Abstract Booklet



TEMPERATURE STRUCTURES AT HIGH HALL DRIFT IN ALUMINUM

B.B.Boiko, V.R.Sobol, O.N.Mazurenko, A.A.Drozd
(Institute of Physics of Solids and Semiconductors ASB,
P.Brovka Str. 17, Minsk 220072, Belarus)

The problems of non-linearity of aluminum disk shaped samples resistivity in magnetic field have been investigated in the regime of current supply, the current being made to flow between inner and outer concentric contacts, an external magnetic field being applied normally to the current flow. For the tasks to have been studied it was nesessary to measure a voltage-current characteristics describing the total value of magnetoresistance and its allocation through the sample, the potential contacts being placed on the sample surface along radius. The levels of current density up to 6500 A/cm² and an external magnetic field of 8 T being used in experiment gave a possibility to achieve the joule energy dissipation corresponding both first and second helium boiling crysis. The voltage-current characteristics as a measure of medium resistivity and heat generation had shown the ordering of heat regime in the vicinity of boiling crysis. In definite dynamic current range (current density is of the order of 4000 A/cm²) at magnetic field over 4 T there take place a stabilization of voltage indicating that some temperature structure occurs. The analysis of such stabilization is being done on the base of presentations on open thermodynamical systems near equilibrium state. The system evolution in time is described with temperature being a field function and depending on spacial coordinates. The temperature corresponds to the equation in partial derivatives with respect to time and coordinates because temperature inhomogeneities lead to heat transfer, the heat generation and elimination functions being taken into account. The characteristic equation for steady case is analysed in linear approximation for the cylindric geometry in accordance with a temperature dependence of heat generation function having a negative derivative and boiling helium curve of N type, the total thermodynamical principle of minimal entropy production for open system at stationary conditions being used.

This research is supported by Fund of Fundamental Investigations of the Republic of Belarus (Grant No. F40-249)