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CRYOGENIC ENGINEERING CONFERENCE

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INTERNATIONAL CRYOGENIC MATERIALS CONFERENCE

JULY 24–28, 1989

UNIVERSITY OF CALIFORNIA, LOS ANGELES
LOS ANGELES, CALIFORNIA 90024
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BP-19

STRAIN-HARDENING AND SOFTENING OF Fe-Cr-Ni ALLOYS DUE TO ε AND α MARTENSITE FORMATION, M. M. Chernik, L.V.Skibina, V.Ya.Ilichev, Physico-Technical Institute of Low Temperatures, Ukrainian Acad. of Sciences, Kharkov-- The $\gamma \rightarrow \varepsilon$, $\gamma \rightarrow \alpha$ and $\gamma \rightarrow \varepsilon \rightarrow \alpha$ martensite transformations may occur during straining of FeCrNi alloys being in metastable state.Different types of transformations are realized in various temperature ranges depending on deformation extent.An attempt was made here to separate the influence of each martensite phase on strain hardening.It is established,That the value of work-hardening coefficient correlates with the increment value of α martensite during low temperature deformation of Fe18Cr10Ni and Fe18Cr15Ni alloy single crystals indicating the hardening action of α martensite.An analytical dependence between these characteristics was found and it was shown that the hardening due to α martensite occurs by Orowan mechanism.Martensite transformation may also lead to alloy softening,since the process of martensite transformation is of shear character, and the volume changes too. The martensite transformation effect on deforming stress was analysed considering changes in sample during this trsnaformation. The conditions were determined at which the martensite transformation leads to hardening or softening during plastic defprmation.Softening due to the $\gamma \rightarrow \varepsilon$ transformation is illustrated on the polycrystalline 18Cr15Ni alloy sample.

BP-20

ELECTRICAL AND THERMAL CONDUCTIVITIES OF HIGH PURITY ALUMINUM AT LOW TEMPERATURES IN MAGNETIC FIELDS, J. Egan and R. W. Boom, Applied Superconductivity Center, University of Wisconsin, Madison, WI 53706 -- The electrical and thermal conductivities of 172, 1530, and 10,000 RRR high purity aluminum is reported for temperatures from 6 K to 90 K in transverse magnetic fields up to 4 T. Each sample remained fixed and undisturbed throughout all measurements. Zero field measurements are taken from 4 K to 300 K.

Work sponsored by the Wisconsin Electric Utility Research Foundation.

BP-21

ON THE PROBLEM OF CRYOGENIC ELECTRON DEVICES DESIGN USING THE LOW-TEMPERATURE THERMOMAGNETIC PHENOMENA IN NORMAL METALS, T.A.Krivoruchko, V.R.Sobol, Institute of Solid State Physics and Semiconductors of Byelorussian Academy of Sciences, BSSR, Minsk -- The investigation deals with the problem of development of cryogenic electron devices using low-temperature galvano- and thermomagnetic phenomena in normal metals. For example, the operation principle of widely used barretter is based on its N-shape voltage-current characteristic, which permits to stabilize the output current in the wide range of input voltage. Our investigations of voltage-current characteristics of copper single-crystals in strong transverse magnetic field show the existence of N-shape dependence of the output voltage on the supplied current. This is due to the nature of the electron system reply on the external perturbations (electric and magnetic fields) in the presence of metal kinetic coefficients anisotropy. The observed phenomena gives the opportunity of design of the voltage-stabilizing devices with output resistance of about 10^{-8} Ohm.

BP-22

ON THE ANISOTROPY OF ELECTRON-DISLOCATION SCATTERING IN ALUMINUM IN CHARGE TRANSFER ,* V.I.Gostishchev, S.E.Dem'yanov, D.V.Pashik, V.R.Sobol, Institute of solid state physics and semiconductors of Buelorussia Academy of Sciences, BSSR, Minsk -- At last time, the problem of peculiarity of electron-dislocation scattering is widely discussed. During the analysis of the temperature dependence part of the resistivity ρ_t it was concluded that negativ deviation from Mattiessen's rule is connected with the increase of anysotropy of electron-dislocation scattering. We have studed the influence of low temperature plastic deformation on ρ_t of very pure aluminum directly after deformation and after annealing of the point defects. It was shown that the sign of the deviation from Matthissen's rule is determined by correlation between the residual resistivity ρ_0 and ρ_t. Thus, we can't conclude, that in zero magnetic field the anisotropy of electron-dislocation scattering will increase with the increase of the dislocation density. When strong magnetic field is applied, the transverse magnetoresistance is noumonotone function of deformation, that directly indicate the anysotropy of electron-dislocation scattering.

JULY 25, 1989 - Session BX (ICMC)

HIGH-T_c SUPERCONDUCTORS: PROCESSING
(ICMC Oral)
Haines 39

Chairman: K. Tackikawa
Tokai University
Japan

2:00 pm BX-01

STUDIES ON THE Bi-(Pb)-Sr-Ca-Cu-O SUPERCONDUCTING TAPES, H.Sekine, K.Inoue and H.Maeda, NRIM, 1-2-1, Sengen, Tsukuba City, Ibaraki 305, Japan, and K.Numata, ATRC, MHI Ltd., 1-8-1, Sachiura, Kanazawa-ku, Yokohama, Japan -- The Bi-(Pb)-Sr-Ca-Cu-O superconductor has been fabricated into tapes without sheath and into multifilamentary wires and tapes with Ag sheath. Superconducting properties, workability, possibility of forming superconduting phase in a long wire, morphology, effects of compacting, effects of c-axis alignment and so on have been studied. Tape specimens prepared by combination and repetition of cold work (or cold press) and sintering showed critical current density, J_c as high as 5×10^3 A/cm^2 at 77K with good reproductivity and reliability, although these specimens are sufficiently thick (0.5-1.0 mm). (Generally, J_c at zero field is inversely proportional to thickness.) For these tape specimens with Cu sheath , sintering and J_c measurement were performed after the Cu sheath was removed. X-ray analysis showed that most of these tape specimens consist purely of high-T_c phase (~107K). In these specimens, c axis tends to align well. This c axis alignment may be a cause of the enhancement in J_c. On the other hand, the tape specimens cold-worked and sintered only once (not repeated) showed J_c as small as only 10^2 A/cm^2. (They showed no sign of the c axis alignment.) A 1330-filament Bi-Pb-Sr-Ca-Cu-O wire with Ag sheath has been successfully fabricated. This multifilamentary wire shows critical temperture, T_c of ~105K. A multifilamentary tape specimen fabricated by a combination of cold work and sintering showed J_c of 1.05×10^3 A/cm^2 at 77K.

BX-02

FABRICATION AND PROPERTIES OF FLEXIBLE TAPES OF HIGH-T_c Bi(Pb)-Sr-Ca-Cu-O SUPERCONDUCTORS, K.Togano, H.Kumakura, D.R. Dietderich, H.Maeda, E.Yanagisawa[z] and T.Morimoto[f], National Research Institute for Metals, 1-2-1, Sengen, Tsukuba, Ibaraki 305, Japan, [z]Asahi Glass Research Center, Hazawa, Kanagawa, Yokohama 221, Japan — Flexible tapes of high-T_c Bi(Pb)-Sr-Ca-Cu-O superconductor have been successfully prepared by the combined processes of doctor blade casting, cold rolling and sintering. The addition of intermediate cold rolling produces alignment of high-T_c plate-like grains parallel to the tape surface. This alignment is considered to be one of the sources for the higher sample density and bonding between the grains. The tapes have sufficient flexibility to be bent into a 30mm diameter cylinder after the final sintering. The bending occurs elastically and the elastic behavior seems to be maintained up to failure. Since the grains are aligned in such a way to maximize the intergrain electronic coupling, a significant improvement of transport critical current density J_c has also been achieved. A zero resistance T_c has been attained at 107K. The highest J_c obtained so far is about 1850A/cm^2 at 77K and zero magnetic field. The J_c of this material has a smaller magnetic field dependence than that of bulk samples prepared by conventional sintering methods.