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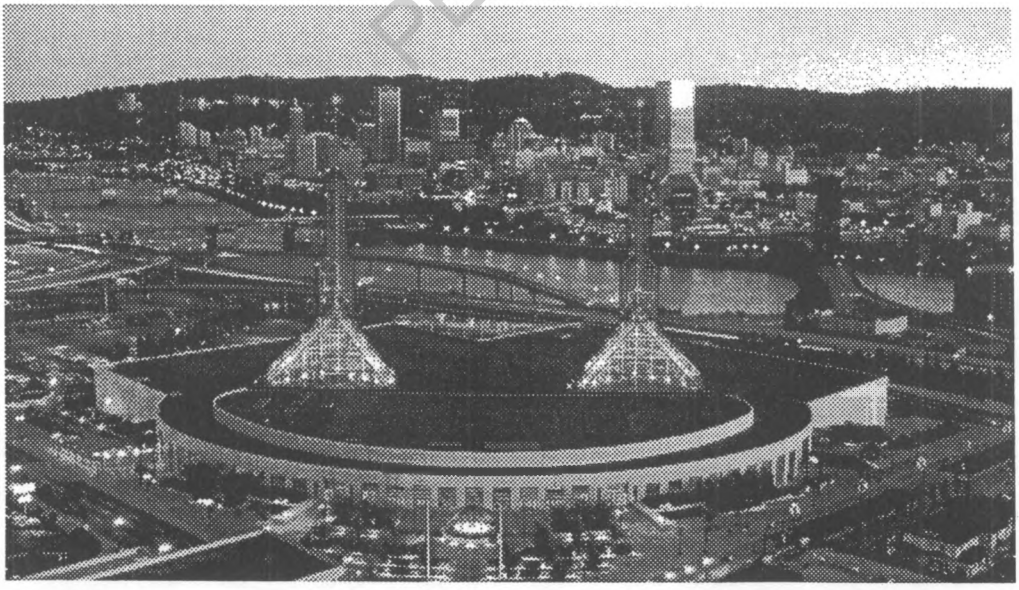
CONFERENCE ABSTRACTS



"Pioneering Development in Cryogenic Engineering and Materials"

GC-5

EFFECT OF HYDROGEN ON CRYOGENIC MECHANICAL PROPERTIES OF Cr-Ni-Mn-N AUSTENITIC STEELS, L.M.Ma, G.J.Liang, J.Tan and Y.Y.Li, Institute of Metal Research, Academia Sinica, Shenyang 110015, China - The method of high-pressure hydrogen charging was used to investigate the internal hydrogen effects on cryogenic mechanical properties of Cr-Ni-Mn-N austenitic steels, 22-13-5 and 21-6-9. Specimens saturated with hydrogen up to 65 ~ 68 ppm were tested in air at temperature ranging 293 to 77K. Hydrogen caused the increase in cryogenic strength, both yield strength and ultimate tensile strength. Hydrogen decreased cryogenic ductility, ductility losses varying with temperature, the maximum hydrogen embrittlement (HE) tendency was found at a certain low temperature. Cr-Ni-Mn-N austenitic steels showed the feature: $\delta_L > \psi_L$ at low temperatures, here, δ_L and ψ_L are the hydrogen induced loss rates of elongation and reduction of area, respectively. Hydrogen had less effect on cryogenic Charpy impact toughness, however, hydrogen decreased cryogenic fracture toughness of the steels. At temperature below M_d, the fracture toughness obviously decreased due to the formation of strain-induced martensites, whether hydrogen charged or not.

GC-6

NON-EQUILIBRIUM SEGREGATION AND FRACTURE MECHANISM OF HIGH-Mn CRYOGENIC STEELS, K. S. Xue, D. Y. Sun,* Z. R. Xu**, B. Wang, J. Li, J. Q. Shen and W. Wang, Shanghai Research Institute of Materials, 99 Han Dan Rd., 200437, Shanghai, China.-The non-equilibrium segregation of manganese at grain boundaries of Hi-Mn austenitic steels has been reported in our previous work. In this paper, the existence of manganese segregation has undoubtedly been proved again by both AES and TEM-EDS analysis. It was also demonstrated by test results that the intergranular fracture of Hi-Mn steels at cryogenic temperature was caused by manganese segregation. Deformation behaviors of Hi-Mn steels with different manganese contents were determined. Low temperature toughness of Hi-Mn steel in various heat treatment conditions was also determined. Based on these data, a new intergranular fracture mechanism of Hi-Mn austenitic cryogenic steel is discussed. The "hard shell" model for intergranular fracture of Hi-Mn steels at cryogenic temperature was proposed by Xue in his previous work has been proved by the ultramicro hardness test.

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SESSION GD: Novel Concepts/Devices.
B117-119
Ch: J. Weisand II CCh: J. Hull

GD-1

THE ELIMINATION OF OXIDES OF NITROGEN FROM THE EXHAUST OF A DIESEL ENGINE USING CRYOGENIC AIR SEPARATION, A. Manikowski, and G. Noland, G and A Associates, and M. A. Green, Lawrence Berkeley National Laboratory - -- The high temperatures associated with combustion in diesel Engines produce oxides of nitrogen as a pollutant. Under the Clean Air Act, it is desirable to eliminate both the oxides of nitrogen and particulate matter from diesel engine exhaust gasses. This paper presents a method for eliminating oxides of nitrogen from the exhaust stream by eliminating the nitrogen from the incoming air entering the engine. The proposed cycle for a crogenic separation system that separates the oxygen and heavy inert gasses from nitrogen in the air is discussed. Much of the power needed to operate the cryogenic separation plant would come from the heated exhaust gas stream from the engine. Since there is almost no nitrogen in the incoming oxidizer stream, the engine can be run much leaner to reduce carbon monoxide, hydrocarbons, and particulate emissions from the engine exhaust stream.

GD-2

THE COLD NEUTRON SOURCE OF THE MUNICH RESEARCH REACTOR (FRM), H. Gerstenberg, E. Krähling, D. Päthe and K. Schreckenbach, TU Munich, D-85747 Garching, Germany - In order to satisfy the growing need for neutrons exhibiting particularly long wave lengths for high resolution scattering experiments the 4 MW Munich Research Reactor (FRM) has been equipped with a cold neutron source, which is based on the additional moderation of thermal neutrons in subcooled liquid hydrogen. The corresponding moderator chamber ($V \simeq 0.9$ l) is installed within a beam tube at a distance of only a few cm from the reactor core. It is exposed to a thermal neutron flux density of $\Phi \simeq 2.5 \times 10^{13} cm^{-2} s^{-1}$. Its rectangular shape provides a good illumination of the adjacent neutron guides. The conflicting needs for high transmission of subthermal neutrons and mechanical strength of the moderator chamber was solved by a construction combining thin Al walls (d = 1 mm) with a structure of 178 internal support rods. Due to the γ-radiation related heat load from the reactor core the H_2 coolant circuit is driven by natural convection only between the moderator chamber and a H_2/He heat exchanger installed about 2.5 m above the core level within the reactor pool. A specially designed He-gas barrier separates the cold source from the neutron guides which lead the cold neutrons to the experimental sites in a separate building. The cold neutron (capture) flux density at the exit of the neutron guides was mesured to be $\Phi \simeq 2.5 \times 10^{8} cm^{-2} s^{-1}$.

GD-3

MAGNETOSTRICTIVELY ACTUATED STICK-SLIP LINEAR TRANSLATION MECHANISM, C. A. Lindensmith, Robert G. Chave, Inseob Hahn, and Martin B. Barmatz, Jet Propulsion Laboratory, Low Temperature Science & Engineering Group, Pasadena, California 91109 - An inertial-reaction linear-translator mechanism, based upon a magnetostrictive actuator material, is described. The proof of concept device, which operates at room temperature, is capable of step sizes under 50 nm, and is thought to be the first such device based on magnetostriction. Reliable minimum step sizes below 10 nm are anticipated. Slewing rates with step sizes of 5000 nm have been achieved. Travel is limited only by the length of the ways upon which the stage moves, and lengths of tens of centimeters are feasible. Tests of the room-temperature device are described, as is progress on the development of a device for use at 4 K, where new giant-magnetostrictive terbium-dysprosium based materials are capable of much larger displacement than piezoelectric crystals. Given the higher performance available in the cryogenic version of the actuator, maximum slew rates are expected to increase at low temperature, with the minimum step size unchanged. Possible conversion of the device for use in zero-gravity will also be described. This device has potential applications in low-temperature scanning-tunneling microscopy, in addition to other low-temperature applications requiring fine motion control plus the capability of moving large distances.

GD-4

NOVEL CONCEPT OF HYPERCONDUCTING CONCENTRATOR OF MAGNETIC ENERGY,* V.R.Sobol, O.N.Mazurenko, A.A.Drozd, and B.B.Boiko, Institute of Solid State and Semiconductor Physics, ASB, Minsk 220072, Belarus - The properties of Hall drift of electrons and generation of respective self magnetic field are examined. The problem of design of high effective cryogenic generator of magnetic field advances the requirement of optimization of magnetic system geometry for the most magnitude of field to be obtained in the same volume at the same energy supply. Besides an electron drift along electric field there is a transverse drift of carriers stimulated by Lorentz force if magnetic field is applied. Generally transverse Hall drift as a source of magnetic field is ignored. A paper is represented here to indicate a novel way of improvement of magnetic system arrangement and efficiency. It is based on validity of use the energy concentrator made from high purity aluminum. Such concentrator may be installed into traditional solenoid and as a consequence the magnitude of magnetic field will increase. An experiment on Al disk conductors having inner and outer concentric current leads is made in coaxial magnetic field of 8 T. Current density is sufficient to achieve a boiling crysis of helium. It is shown that magnetic field of solenoid will be increased in volume of concentrator in accordance with power type law instead of summation taking place in many layer solenoid system. The benefits and advantages of application of magnetic field of Hall drift are discussed. Parameters together with all necessary requirement for operation are represented for cryogenic range of temperature 4.2 - 30 K.

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