United States and Israel Sign Agreements for Cooperative Energy Research and Development Projects

The U.S. Department of Energy and the Israeli Ministry of Energy and Infrastructure have signed two annexes to the United States/Israeli Agreement in Energy Research and Development. The annexes establish projects in high temperature receivers and materials for hydrogen heat pumps.

The annexes established two new projects in which work will be conducted over a two-year period. The first annex matches the Sandia National Laboratory in the United States and the Weizmann Institute of Science in Israel with the objective of advancing understanding and use of ceramic receivers by conducting tests on a U.S. (Black and Veatch) ceramic receiver. The two organizations will also conduct tests on solar-heated thermochemical reactors. All tests will be conducted at the Weizmann Institute Central Receiver Facility.

The second annex involves the Brookhaven National Laboratory with the Technion to evaluate the possibility of utilizing suspensions of metal hydrides in organic or aqueous solutions as materials for hydrogen heat pumps or similar devices.

The agreement establishing the cooperative framework for energy R&D projects was signed by the two governments in June 1984 and covered energy technologies in the areas of solar energy, photovoltaics, biomass, conservation and fossil energy. Since 1984, ten annexes have been signed under the agreement covering specific projects in exchange of information and personnel, several projects in oil shale, and individual projects in coal conversion, biomass and solar energy.

Los Alamos Develops Two New Ways to Measure Superconductors

Researchers at Los Alamos National Laboratory's Medium-Energy Physics and Accelerator Technology divisions are developing two new techniques to measure the efficiency of new high temperature superconducting materials. Both measurement techniques use radio-frequency waves, whereas other measurement methods have relied on electrical contacts to gather data on superconductors. According to researchers, radio-frequency electromagnetic fields are useful in measuring superconductors because they provide information on electrical resistance without touching or affecting superconductors. The level of electrical resistance in the superconducting sample modifies the electromagnetic fields, which are measured and interpreted. The resistance is dramatically decreased when superconductivity is achieved.

Wayne Cooke, a solid-state physicist and project leader for the research, points out that the two approaches can piggyback each other and are already being used to measure the performance of new superconductors. Those superconductors are being developed in separate research programs in the Lab's Center for Materials Science and in the Materials Science and Technology division.

One of the measurement techniques, called the eddy-current technique, produces a quick analysis of a superconductor's general performance. Based on those findings, obtained in less than 90 minutes, researchers can screen potential superconducting materials and decide which ones should have more detailed analysis.

The other approach uses the Lab's first niobium superconducting cavity, for a more accurate and comprehensive analysis taking about six hours.

Lab researcher James Doss explained that the eddy-current technique measures superconductor properties continuously from room temperature to near absolute zero, about -452°F, and back up to room temperature again. Cliff Fortgang, who works with Cooke on the niobium cavity, says their approach now measures superconductors only at room temperature and at -452°F, but the device will soon be modified to take continuous measurements.

High Critical Temperature Superconducting Film Made Using Low-Pressure Plasma Spraying

Nippon Kokan (NKK), together with Tokai University Prof. Kyoji Tachikawa, has manufactured a yttrium-barium-copper oxide superconducting film using a low-pressure plasma spraying process. According to NKK spokesman the new film has characteristics superior to those now produced, and low-pressure plasma spraying is expected to attract considerable attention in the manufacture of superconducting coils, magnetic shielding materials, and other products.

In the process, oxide powders of yttrium, barium and copper are charged into a high-temperature plasma jet that melts the chemicals and sprays them onto a nickel alloy (Nimonic) substrate to form the film. The spraying is conducted in an ambience-controlled chamber where the pressure is kept between 1/40–1/4 atm. By optimizing the pressure level and the types of ambient gases present, the new process enables the creation of superconducting films whose adhesion, density and composition are superior to those of films produced by the atmospheric (1 atm) plasma spraying process.

The film produced is about 100 microns thick and has zero electrical resistance at 91 K. It has a critical current density of 700 A/cm^2 at 77 K. The Meissner effect was also confirmed at 77 K.

Non-spraying methods to manufacture superconducting films—sputtering, electron beam vapor deposition, and excimer laser vapor deposition—all produce films that are less than 2 microns thick at speeds lower than 0.05 microns per minute. NKK said its new process, produces a film with a thickness of about 100 microns at a speed more than 1,000 times faster than is possible with other methods.

Prof. Tachikawa and S. Kosugi of NKK's Steel Research Center presented the results of their research at the 1987 MRS Fall Meeting Symposium on High-Temperature Superconductors held the first week of December.

ONR Announces Expanded Graduate Fellowship Program

As one means of increasing the supply of U.S. citizens trained in disciplines of science and engineering critical to the U.S. Navy, the Office of Naval Research (ONR) has expanded the ONR Graduate Fellowship Program. ONR plans to award as many as 50 new three-year fellowships to recent outstanding graduates to support study and research leading to doctoral degrees in specified disciplines.

New ONR Graduate Fellowships awarded in 1988 will be for study and research in ten major disciplines. Specialties of particular importance to current and future naval technology are listed under ten major disciplines. Preference will be given to applicants who indicate an intention to pursue continuous study and research leading to a doctoral degree in, or closely related to, one of these specialties.

Electrical Engineering
- Integrated Circuit Design and Fabrication
- Communications
- Solid State Devices

Electromagnetics
Signal Processing
Quantum Electronics
Mathematics
Applied Mathematics
Mathematical Statistics
Discrete Mathematics
Computational Mathematics
Computer Science
Software and Systems
Artificial Intelligence
Architecture, Algorithms, and Software
Advanced Automation
Robotics
Naval Architecture and Ocean Engineering
Ship Structures
Structural Acoustics
Ship Hydrodynamics
Marine Engineering Materials Science
Processing and Fabrication
Composites and Fibrous Materials
Reliability and Materials Evaluation
Optical Electrical, and Magnetic Materials
Corrosion Science
Welding and Adhesion Science
Energetic Materials Synthesis
High Temperature Materials
Applied Physics
Laser Physics
Surface Physics
Physical Acoustics
Underwater Acoustics
Opto-electronics
Aerospace/Mechanical Engineering
Experimental Fluid Dynamics
Computational Fluid Dynamics
Energy Conversion
High Temperature Solid Mechanics
Manufacturing Engineering
Systems Engineering
Biological/Biomedical Sciences
Genetic Engineering and Biopolymers
Neuroimmunology
Biomaterials
Cognitive and Neural Sciences
Biocybernetics and Artificial Intelligence
Neuroplasticity
Neural Architectures

ONR Graduate Fellowships are limited to citizens of the United States. Eligibility is further limited to those individuals who will receive their baccalaureate degree in 1988, or who, by reason of military service or other circumstances, have not attended graduate school in science or engineering since receiving their baccalaureate degree. Naval officers meeting the requirements are eligible for this program.

A complete ONR Graduate Fellowship Application must be submitted to qualify for consideration. A complete Fellowship Application consists of (1) master personal information form, (2) transcripts, (3) three letters of recommendation, and (4) Graduate Record Examination results (general test only).

Application materials may be obtained from the American Society for Engineering Education (ASEE), 11 Dupont Circle, Suite 200, Washington, DC 20036; telephone (200) 745-3616 or (202) 293-7080.

The deadline for filling applications for ONR Graduate Fellowships with the ASEE is *February 1, 1988*.

All applicants will be notified by letter, at their reported permanent address, of the outcome of their applications on or about April 15, 1988.

Robert Schrieffer Named Fellow at Los Alamos

Nobel Laureate Robert Schrieffer will become the first Public Service Company of New Mexico (PNM) Senior Scientist Fellow in high temperature superconductivity at Los Alamos National Laboratory. The fellowship was established as part of a two-year, $570,000 grant by PNM to Los Alamos. The research program to be headed by Schrieffer is called "Advanced Study Program in High-Temperature Superconductivity Theory." Schrieffer will spend two months a year at Los Alamos on this program.

"The program will emphasize a substantial postdoctoral, graduate student and visitor program to help establish the theoretical base which the field of high temperature superconductivity will need in the future," said Sig Hecker, Los Alamos director. "Through Prof. Schrieffer we've already recruited other top theorists in the world as participants."

Joining Schrieffer as visiting staff for portions of the coming year will be Profs. Elihu Abrahams of Rutgers University, Sebastian Doniach of Stanford University, David Pines of the University of Illinois, and T. Maurice Rice of ETH Zurich, as well as Los Alamos Fellow James Krumhansl of Cornell University.

The program will shortly begin recruitment of applicants for graduate students and postdoctoral candidates for year-round fellowships at the Los Alamos Center for Materials Science, where the advanced study program will be located. The initial program is jointly funded by PNM's grant and the Lab. Both institutions will be actively seeking other industry contributions to expand the program.

Schrieffer received the 1972 Nobel Prize in physics for his co-development of the Bardeen-Cooper-Schrieffer theory of superconductivity. He is a leading figure in the international condensed matter science community and is currently professor of physics and director of the National Science Foundation Institute for Theoretical Physics at the University of California at Santa Barbara.

Medical Applications Cited as Only Successful Current Commercialization of Superconductivity

Characterized as small but thriving, medical applications represent the only current commercial successes in superconductivity, according to a recent report in *Superconductor Week*. This view was expressed by speakers at the Institute for International Research conference held in mid-November in San Francisco. According to *Superconductor Week*, Alan Schriescheim, director of Argonne National Laboratory, predicted significant economies of scale when the new materials are adapted to magnetic resonance imaging (MRI). He indicated that MRI installation costs, now on the order of $100,000, would be reduced by approximately 50%, and that coolant bills on the order of $30,000 annually using liquid helium could be reduced tenfold using liquid nitrogen.

It was estimated that companies that manufacture MRI units spend $250,000–$500,000 on the superconducting magnet system (including cryogens, superconducting coils, and electronics), of which the superconducting component is the most expensive part.

Another area in which superconductors could be applied in medical diagnostics was seen in the area of magnetic resonance spectroscopy (MRS), which is useful in exploratory work, treatment, and surveillance of diseases. □

MRS BULLETIN Welcomes New Editorial Board Member

Professor H. Li of Tsinghua University, Beijing, China, has joined the Editorial Board of the MRS BULLETIN as of January 1, 1988, according to Editorial Board Chairman Elton N. Kaufmann. Dr. Li has been Director of the Research Institute of Materials Science of Tsinghua University since 1979, having assumed that position after serving as chairman of the Engineering Physics Department. Since 1986, he has also held the position of Director of Materials and Engineering Sciences for the National Natural Science Foundation of China (Beijing).

Professor Li attended the National Northwestern College of Engineering in China (BS, 1942), the Carnegie Institute of Technology (MS, 1947), and the University of Pennsylvania (PhD, 1953). His primary research interests involve the study of nuclear materials and ion beam-solid interactions. MRS is pleased that Prof. Li has consented to help the BULLETIN as it assumes an increasingly international character and readership. Readers who would like to contact Prof. Li directly will find his address on page 2 of this issue.

The Editorial Board of the MRS BULLETIN has been serving MRS for over four years. Most original members continue to serve to the present and a few new members have been added along the way. The Board has served the BULLETIN in several capacities, acting as book review editors, suggesting and soliciting individual technical articles, providing research community news, and helping to identify topical themes of interest to BULLETIN readers. During 1988, several more new members are expected to join the Board as initial terms of service come to a close, according to Kaufmann.

Boyd Succeeds Golanski as MRS BULLETIN Associate Editor-Europe

Professor Ian W. Boyd, of the Department of Electronic and Electrical Engineering, University College London, has been named Associate Editor-Europe for the MRS BULLETIN. The position of Associate Editor-Europe was created in 1987 in response to burgeoning materials research activities in Europe and the rapidly growing European Materials Research Society organization, whose members receive the BULLETIN. The Associate Editor-Europe role is intended to be filled on a rotating basis from year to year. Dr. Andre Golanski of CNET Grenoble, who, as first Associate Editor-Europe, has been responsible for markedly greater Europe-related content in BULLETIN pages, has shaped an editorial and correspondents resource which will serve the BULLETIN well in future years.

Boyd graduated in physics from Herriot-Watt University (Edinburgh) in 1982 and spent two years at North Texas State University's Center for Applied Quantum Electronics before assuming his current position. His technical interests include laser processing and thin silicon dioxide structures.

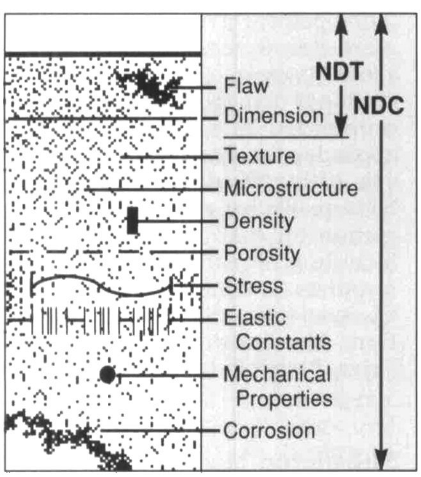
The BULLETIN encourages readers in Europe or readers who have specific interests in coverage of European materials research topics and organizations to contact Prof. Boyd directly at the address given on page 2 in this issue.

https://doi.org/10.1557/S0883769400066471 Published online by Cambridge University Press

Nondestructive Characterization: science, technology, applications, and the...

The whole concept of applied ultrasound has been redefined by Ultran so that you can reliably characterize materials for texture, micro/atomic structure, elastic constants, etc..., during changes of state, and throughout a processing sequence because your samples are never destroyed. Now's the time for you to step ahead and learn what it can do for you.

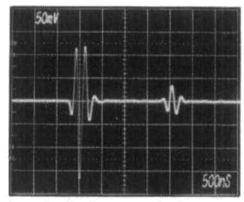
The full development of ultrasound, permitting the reliable characterization of materials without destroying them, is what started Ultran Laboratories ten years ago. Today, we've succeeded in pushing ultrasound beyond the superficial level of Nondestructive Testing (NDT).



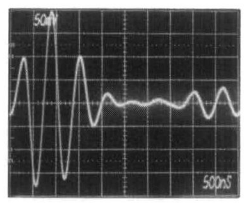
Now it is to the point where it can be used for Nondestructive Characterization, NDC. NDC actually allows you to evaluate a material's properties and to quantify its micro and atomic structures, not merely detect overt flaws. This is what materials scientists and technologists have always wanted for materials' development, manufacture, and applications. And it's reliable.

Reliability of a testing method is obviously necessary if you're to make logical deductions about a material or its processing. Ultran's NDC approach is reliable for three reasons.

- First is the validity of basic principles. Like all other wave forms, ultrasound abides by the laws governing reflection, refraction, phase change, etc...... It's naturally predictable.



Longitudinal wave velocity: 413,590in/s (10505m/s)



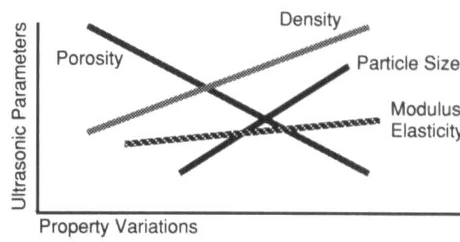
Shear wave velocity: 227,200in/s (5771m/s)

Observations of Dense Alumina by Pulsed Ultrasound, RF A-scan

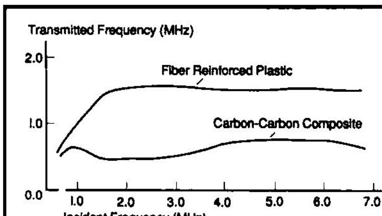
Sample thickness: 0.426in (10.82mm)

Materials Characteristics from above observations:
- Dynamic Young's Modulus: 79.46×10^6psi
- Shear Modulus: 18.56×10^6psi
- Poisson's Ratio: 0.284

Measurement of longitudinal and shear wave velocities alone gives you elastic constants and textures of your materials. This information can also be directly correlated to the materials engineering properties. These nondestructive methods can now be applied to your QC, QA, product development, and materials R & D.



- The second is the qualitative advances Ultran has brought about in ultrasonic hardware. We deliver ultrasound that is more applications-specific. Our controlled acoustics provide pulse widths as narrow as the theoretical minimum of 0.5l to >6.0l, and in frequencies from <100KHz to >100MHz. All this means that you can characterize materials varying in microstructure or texture from porous and granular to superdense and superhard. Materials like ceramics, plastics, rubber and tires, tissues, lumber, pulp and papers, liquids, concretes, foams, composites, rocks and minerals, and even gases. You can evaluate their texture, microstructure, density, porosity, dimensional features, elastic constants, mechanical properties, applied and residual stresses, corrosion, and, of course, for flaws. And you can observe how their characteristics alter during crystallization, polymerization, liquefaction, solution, phase transformation, densification, superconductivity, etc. All without destroying or altering a single test material.



Transmission of Ultrasound Through Materials when Excited by Broad Bandwidth Ultrasound Sources

- Third, Ultran's NDC reliability is due to Ultran's own background, experience, and facilities. We understand materials, as well as ultrasound. In our labs we have successfully answered thousands of our clients' applications needs. We can help you, too, with specific materials characterization, feasibility analysis, research and development, consultancy, as well as the hardware.

Ultrasonic NDC is a new discipline. Ultran has taken it from a possibility to a reliable reality. But it is up to you, the final user of ultrasonic Nondestructive Characterization, to apply and interpret pertinent data for your own specific objectives. Find out how Ultran can help you discover NDC's usefulness and it's excitement in your work.

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https://doi.org/10.1557/S0883769400066471 Published online by Cambridge University Press