Newsletter for the Employees of the Ames Laboratory • Volume 2 Number 1 • January 1991

AMES LAB INSIDER

ON TOUR FOR SCIENCE EDUCATION - See Page 4.

Double the Prestige

AMES LAB WINS TWO MATERIALS SCIENCES AWARDS

Nominated and evaluated by their colleagues in the national labs, Senior Chemist Robert McCarley and Senior Physicist Clifford Olson came out winners in DOE's 1990 Materials Sciences Research Competition. Ames Lab enjoys double category prestige, being recognized by the DOE for exceptional research in both Materials Chemistry (McCarley) and Solid State Physics (Olson).

ROBERT MCCARLEY- MATERIALS CHEMISTRY, SUSTAINED RESEARCH

Expressing pleasure and enthusiasm in winning the 1990 Materials Sciences Award, McCarley says, "This tribute indicates that after many years of hard work and, I think, nice chemistry, the DOE recognizes the value of that work in the form of this award. Of course, co-recognition must go to the students and postdocs who contributed ideas and actually performed the experimental work."

McCarley's research in synthetic solid state chemistry focuses on making some very complicated materials, so complicated that many people in the solid state community did not understand or see possible future applications for them. McCarley notes, however, that over the last few years, a renaissance has taken place in the field of synthetic solid state chemistry. "People now realize that we are materials-limited in many areas and we need a lot of options on the kinds of materials available to do specific jobs." Applications for new materials are not always immediately evident. Dedicating time and talent to research new synthetic

Robert McCarley

materials today may well provide the necessary base of materials from which we will draw upon in the future. Stressing the need to expand knowledge on synthetic materials, McCarley asserted, "The business of discovering new materials through an active synthetic program is a very important aspect of solid state science, and it is exactly that emphasis we have in my research program. We are in the business of synthesizing brand new materials, some of which turn out to have very complicated structures, so it takes a while to understand and appreciate them."

One very notable compound synthesized in McCarley's program some years ago is sodium molybdenum oxide ($NaMo_4O_6$). According to McCarley, this compound is significant because it opened up the whole area of reduced ternary or quaternary molybdenum oxides which have structures dominated by metal-metal bonding. The discovery of $NaMo_4O_6$ revealed new structure types ruled by this kind of bonding where it is the combined metal-oxygen and metal-metal bonding that determines the structure. Those kinds of structures in oxide systems were not known before McCarley's research.

Another category of compounds being investigated by McCarley's research group is metal-sulfide cluster compounds which are thought to have potential as catalysts, especially as catalysts for hydrodesulfurization, the process by which sulfur is removed from crude oil. McCarley expects research in this area to intensify in the near future.

Commenting on his receipt of the Materials Sciences Award, McCarley credits the collaborative research atmosphere of the Ames Lab which allows easy access to scientists in all disciplines. He highly praises the assistance given to his program by Robert Jacobson's group in x-ray diffraction. "We have to determine the structure of our compounds before we know what we're dealing with; that's a very vital part of what we do. Jacobson's program in x-ray diffraction has greatly facilitated that and, in several cases, has been absolutely essential to the solution of the structure."

McCarley's award for sustained research in the materials chemistry category recognizes a continuous research effort over a number of years. "One of the great things about the research programs in the Ames Laboratory is that there is a more stable source of funding over a period of years that can nurture and sustain a program like this. I am very pleased to have received that kind of support from the DOE."

CLIFFORD OLSON- SOLID STATE PHYSICS, OUTSTANDING RESEARCH

Based at the Wisconsin Synchrotron Radiation Center in Stoughton, WI, Ames Lab Senior Physicist Clifford Olson has done some remarkable research in high-resolution angle-resolved photoemission studies of high-temperature superconductors. Remarkable research merits unique recognition, and so it goes with Olson, who won this year's Materials Sciences Award for outstanding contributions in the solid state physics category. "It feels great to receive this type of award from your peers! It's very gratifying to know that people feel your work has made an impact."

Clifford Olson

The impact is a significant one since Olson's research greatly furthers efforts to comprehend the phenomenon of high-temperature superconductivity, the property that enables a material to carry an electric current with no resistance losses. "When high T_c superconductors came along, the idea of something that different led to a lot of novel explanations of what might be going on," Olson explains. "Photoemission provides the means to put some constraints on the picture." Olson explains when electrons in a material are excited by photons of light, they may have enough energy to escape through the surface. The energy and direction of the electrons after they escape can give detailed information about the energy states in the material.

The surprising result of Olson's photoemission research was how ordinary the superconducting materials looked. Previously, considerable speculation prevailed that these were highly different materials. Olson is careful to clarify that this is not to say these materials are ordinary at all. "Perhaps the real explanation of high T_c may come from the subtle fine differences in the materials," Olson surmises.

Tackling the job of discovering more about those differences, Olson and his collaborators perform the best high-resolution angle-resolved photoemission measurements to date on many of the high T_c superconductors. "When a material goes superconducting there is a gap in the possible energy states at the Fermi level. Most experiments see that gap indirectly as a consequence of the gap having opened. Photoemission provides the ability to see the gap directly and measure just how big it is." Greatly enhancing the quality of measurements obtained, Olson's photoemission work has put some restrictions on previous beliefs concerning the superconducting state.

Quick to point out the importance of collaborative efforts, Olson credits the scientists at Argonne National Laboratory for preparing high quality crystals making photoemission applicable. ❑

The Awards

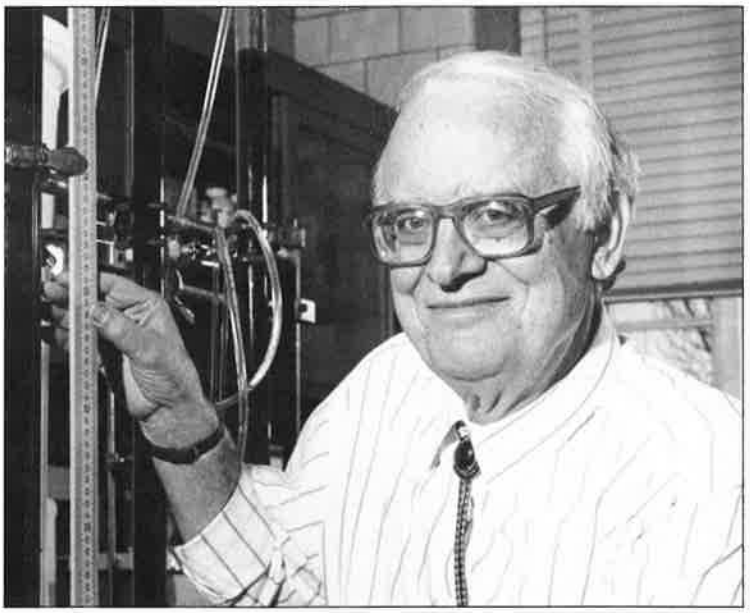
Competition for the Materials Sciences Awards is held annually to foster understanding and appreciation of the high caliber research carried on in DOE laboratories. Applications of all participants are sent to each DOE lab except their own for evaluation. Additionally, materials science staff members in Germantown also evaluate the applications. The awards are made in three categories: (1) metallurgy and ceramics, (2) materials chemistry, (3) solid state physics. "The Materials Sciences Awards recognize the good work done by materials science researchers in DOE laboratories," notes Iran L. Thomas, Director for the Division of Materials Sciences of the Office of Basic Energy Sciences in Washington, DC. "We hope this process encourages a continuing awareness of our desire for innovative and high quality research in the DOE laboratories." As winners of the 1990 Materials Sciences Awards, McCarley and Olson will each receive a special $40,000 to $50,000 capital equipment allocation from DOE.

Purely Powell

Reducing the impurities in an isotope, ^{150}Nd, to parts per billion (ppb) range is a challenge that has lured Jack Powell out of retirement and back to the Ames Lab. The neodymium isotope sample to be purified, weighing approximately 81.4 grams and valued at $2,000 per gram, came from the Soviet Union to the University of California at Irvine. Representatives from the physics department there contacted Karl Gschneidner, Rare-earth Information Center Director, to assist in locating someone to purify the neodymium. Senior Metallurgist Bernard Beaudry took on that responsibility. He found Jack Powell.

Subsequent to writing a proposal and having it accepted, Powell set to work preparing the ion-exchange columns for the purification process, a familiar job after doing this for 45 years during his professional career. Powell smiled, "It feels quite natural to be back at the Lab and working with ion exchange columns again."

Powell will use the displacement chromatographic elution method to reduce the impurities in the ^{150}Nd. He believes this process will lower the uranium (U) and thorium (Th) content to the ppb range and remove radium (Ra) from at least 90% of the recovered neodymium oxide



Jack Powell working with the ion-exchange columns.

POWELL/ *Continued on Page 7* ➪

On Tour for Science Education

Youthful voices in the hallways, elephant thunder in the stairwells, backpacks and coats strewn across auditorium chairs, obvious and unmistakable signs of an Ames Lab tour in progress! What isn't so apparent, perhaps, is the rapt attention and perpetual curiosity of those young visitors within the individual labs where science is happening. Encouraged by a participatory environment, our visitors have the unique opportunity to experience "live" science.

Ames Lab hosts many tours each year for students from the junior high through college levels. During 1990 we were visited by junior high and high school groups from Lake City, Waverly, Carroll and Gilbert as well as students from DMACC in Ankeny and some researchers from Amoco Chemicals. In June we hosted tours for several seventh through tenth grade students involved in two three-week CY-TAG (Challenges for Youth - Talented and Gifted) summer sessions held at Iowa State University (ISU). The CY-TAG program offers in-depth and challenging learning experiences for academically advanced students. Most recently the Lab gave tours to more than 150 ISU freshman honors students during a two-day period. Representatives from the University Honors Program stress Ames Lab's importance to the research and intellectual environment of Iowa State University.

Addressing the DOE commitment to science education and stimulating an interest in creative scientific research, many Ames Lab scientists actively participate in periodic Laboratory tours. Acting upon this opportunity to boost a participation in science outside of the scientific community, Ames Lab researchers are sharing the responsibility of advancing science education. By incorporating science education into their jobs, these forward-looking individuals improve general scientific literacy and cultivate and inspire future scientific talent.

The photos featured with this story are just a sample; many other scientists have contributed their time and talent to Laboratory tours as well. Ames Laboratory extends a sincere thank you to all of these special people. ❑

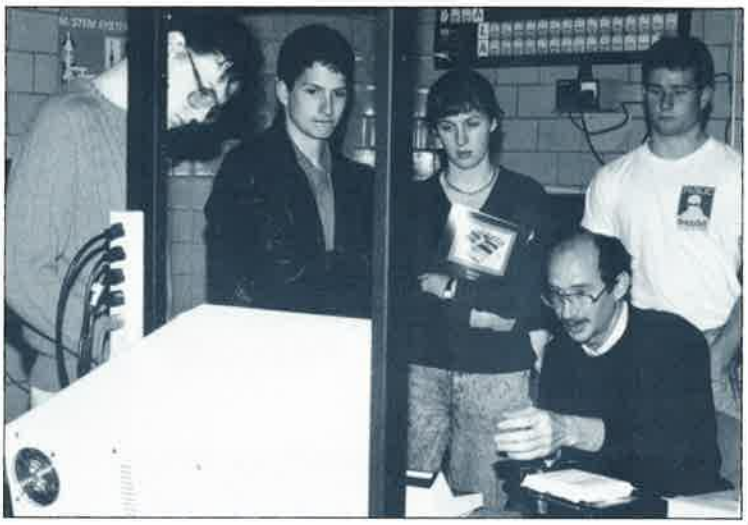
On the cover:
Jerry Ostenson amazes an intent audience with his superconductivity demonstration.

Intriqued by Bernard Gerstein's demonstration, freshmen honors students learn about nuclear magnetic resonance (NMR).

Al Bevelo creatively uses a building block analogy during his presentation on surface analysis by Auger Electron Spectroscopy (AES).

Mitch Meyer demonstrates the high temperature strength of a ceramic fiber.

Fran Laabs involves ISU freshmen honors students in sample analysis with the scanning electron microscope.



Scott Chumbley introduces honors students to the transmission electron microscope explaining its advantages over light microscopy.

Larry Jones explains the Materials Preparation Center (MPC) to touring CY-TAG students.

BULLETIN BOARD

To reserve the conference room in 303 Wilhelm, please call Kris Voga at 4-2327.

Technical Reports

During the months of January and February, the Office of Information will be offering R&D reports from other laboratories as "free issue". These documents are from 1 to 10 years old and cover various subjects. The documents will be available outside 201 Spedding, near the elevator, beginning Monday, January 4. Every Monday morning new documents will be placed on the shelves. At the end of the week, remaining documents will be tossed and new reports will be placed on the shelves for free issue. A limited amount of books will also be available. Please help yourself. Check the January 2 memo for more information.

As of January 1, the Office of Information will no longer receive and store these reports from other laboratories. If you find certain reports of interest to you, we can arrange to have the Office of Scientific and Technical Information, Oak Ridge, send them directly to you. Please contact Beth Weiser, 294-5662 for more information.

Publications Database

In January the Office of Information's publication database will be added to Information Management System (IMS). Searching on the database by authors, keywords from the titles, year, journal titles, or a combination of any of those fields will be possible. In addition, theses will be searchable by author, keywords from titles, year, and major professor. The database will be updated daily. When completed, the database will consist of all Ames Laboratory publications going back to the 1940s including reprints, conference papers, theses, and R&D reports. It is anticipated that it will take two years to enter all existing references into the database; we are adding the most recent entries first and working backwards. When the database is complete the old author notebooks located 201 Spedding Hall will be phased out. For more information on the database, instructions on how to access it, and how to make sure your papers are routinely included, contact Beth Weiser, 201 Spedding, 294-5662.

Pesticides will be sprayed in Ames Lab buildings on Friday, January 11 from 5:30 PM to 9:30 PM. Please vacate the premises during this time. Contact your project leader if this interferes with any experiment in progress.

COMPUTER SECURITY

This month we begin a series of articles on the Automated Information Systems security environment.

The first item to consider is a brief chronology of some of the serious computer crimes that have occurred during the past five years.

1986 - Clifford Stoll discovered the Hanover hacker.
1988 - Worm released on Internet.
1989 - USAF Officer removed floppy disk from secure facility.
1989 - Columbus Day virus.
1989 - Worm invaded NASA.
1990 - Census Bureau recalls virus-infested data disk.

Security may be expressed by three terms: confidentiality, integrity, and availability of service.

Confidentiality is keeping data available only to authorized personnel. For DOE data the previous articles on computer security have described in detail mission critical and sensitive information that the DOE requires us to protect.

Integrity is concerned with preventing, detecting, and deterring improper or accidental modifications of information.

Availability of service implies that the information and the tools to manipulate the information are available when needed in the course of our work.

The following computer security concepts need to be recognized: 1) computer security is an integral and important part of Information Resource Management; 2) computer security is more than just securing the computer; 3) computer security requires techniques and concepts from many disciplines; 4) failure to include all aspects of computer security in the design of an automated information system leads to an insecure system.

There are several inherent computer security problems including insufficient understanding of the value of information; reliance on computers; hostile environment; computers are inherently vulnerable; exploitation of vulnerabilities; lack of security awareness; limited resources - there never seems to be enough time or personnel to do the job correctly; emphasis on user services - we tend to design to please the user without considering computer security; complexity of software - do you really know what is in that slick new package you just put on your PC?

Many information resources need to be protected: information, data, software, hardware, people, facilities and communications.

Accidental, malicious, and natural acts and design limitations are some of the broad types of threats that need to be prevented.

According to Data Processing Management Association the three major perpetrators of computer crime are: current employees, 81%; outsiders, 13%; and former employees, 6%.

Datapro Research Corporation reports the common causes of damage to information are: 52% Human Error, 15% Fire, 10% Water, 10% Technical Sabotage, 10% Dishonest Employees, and 3% Terrorism.

Continued next month.

➪ **POWELL**/*Continued from Page 3*

product.

Asked if he thought this was a unique project, Powell explained it was unique in respect to the level of reduction of the impurities. "Parts per million was usually good enough in the past," he commented, "but parts per billion is unprecedented in my experience and quite a personal challenge."

Materials Preparation Center Director, Rick Schmidt, remarked, "We were quite fortunate to have Powell available for this project. Powell was involved with the ion exchange process for separating the rare earths during his entire tenure at the Ames Laboratory. I believe he is the world's expert at this type of processing."

Why is it so important that the impurities in the ^{150}Nd be reduced to ppb levels? Beaudry offers this explanation. The unstable ^{150}Nd has an extremely long half-life and so decays very slowly. Scientists at the University of California at Irvine would like to study the nuclear physics of its decay, but the decay process is so slow that, if there is any radioactivity around, it will interfere with their studies. Reducing the radioactive impurities in the isotope to the ppb range or below is necessary for the reliability of the research.

It seems inevitable that this project should fall into Powell's capable hands. As a graduate student he did comprehensive studies on the elution of neodymium with citrate, the same reagent chosen for his current undertaking. Powell noted that he made no promises concerning the overall quality of the $^{150}Nd_2O_3$ product he might recover, but declared that the capability of the displacement chromatographic elution method to diminish impurities has theoretically no limits.

Capable and with no limits is a description that applies to Powell as well. Retired, but not really, Powell has done many things since he left the Ames Lab in 1986. He held a consulting position in inorganic chemistry at the University of Indonesia, has reviewed several scientific books and served as an expert witness in a lawsuit. In addition to these endeavors, Powell has eight grandchildren who keep him active and test his limits from time to time.

In a lifetime filled with accomplishments, Jack Powell has not yet taken time to "retire". Accepting the challenge that the ^{150}Nd project offers is true to his character and purely Powell! ❑

➪ **OI**/*Continued from Page 8*

A memo has been distributed to appropriate program areas listing the details of these changes.

The Office of Information's mission is defined to meet the goals of the Ames Laboratory and the Department of Energy. Please let us know if we can help you with your information needs. ❑

Office of Information Reorganizes

The Office of Information (OI) is reorganizing and taking on a new look. With Pattye Volz's leadership, the Office has examined its mission and evaluated services in order to accomplish new goals.

MISSION

The Office of Information's mission is to strengthen the Laboratory's capabilities through increased visibility and improved information dissemination. The two information areas will continue to be public information and technical information. The greatest emphasis will be on public information, and some technical information functions will be retained. A dynamic public image can augment current recruiting and funding efforts with a direct benefit for the researcher, the Laboratory and DOE.

PUBLIC INFORMATION

The primary goal of the public information area is to improve the Lab's credibility by building internal and external awareness of its accomplishments. OI will seek to accomplish this through a variety of communication methods including publications, media relations and special projects. The Office will work more closely with Iowa State's University Relations Office, IPRT, DOE-CH, and industry, community and legislative leaders, serving as an information contact and enhancing the Lab's visibility.

A new emphasis on communicating research to the news media will increase favorable coverage of Laboratory research. The Office will build relationships with reporters and determine research projects that might interest the media. Increased news coverage can raise public opinion of scientific research and DOE as well as the Laboratory.

The Office will continue to produce the *INSIDER* and will debut *INQUIRY*, a new quarterly science magazine, early this year. Publication plans also include a new series of bulletins to communicate to external audiences. Special-needs brochures will be developed when appropriate.

Examples of special projects handled by the Office of Information may include exhibits, tours and the revamping of the Ames Lab slide show. OI will also provide a leadership role in other special projects dealing with Laboratory events or priorities.

TECHNICAL INFORMATION

The goal of the technical information area is to facilitate the flow of technical information to and from researchers. Offering appropriate information and tools will assist researchers in their quest for increased productivity and publications.

OI will continue to provide computerized literature search services. Literature searching provides quick access to information giving the researcher an efficient method of obtaining data electronically. The Office is also investigating new ways to gather and disseminate useful information from other laboratories through DOE's information services and data bases.

OI will continue to meet DOE's requirements for patent clearing publications, archiving Ames Lab's scientific publications and ordering reprints from the publishers; therefore, a copy of all journal papers, conference papers and theses still need to be submitted to OI. Early in 1991, a database will be functional through IMS allowing Laboratory personnel to search for internal publications. Proofing of the Laboratory's R&D reports will still be provided.

Beginning January 1st the Office will no longer handle the following.

1) Preprint orders - You should order directly from graphics;
2) Reprint requests - These will need to handled within individual program areas;
3) Books orders and subscriptions - You should submit purchase orders directly to Purchasing;
4) Quarterly reports - OI no longer requires or stores these;
5) Weekly Seminar notices - IPRT will provide this service for all of the Institute's centers, including Ames Lab. Please send your seminar notices to Nan Stillians, 216 O & L.
6) The Document Library will no longer exist but we will help locate hard-to-find information and assist with specialized information requests.

OI/ *Continued on Page 7*

AMES LAB INSIDER
Volume 2/Number 1/January 1991

Ames Lab Insider is published 12 times a year for the employees of the Ames Laboratory by the Office of Information. Ames Laboratory is operated by Iowa State University for the U.S. Department of Energy under Contract W-7405-Eng-82, and is part of the Institute for Physical Research and Technology consortium of fundamental and applied research centers.

Address comments to:
Editor, *INSIDER*
201 Spedding Hall
Ames, IA 50011-3020
515/294-1856

Dianne Borgen	*Editor*
Saren Johnston	*Writer*
Avinash Pancholi	*Graduate Assistant*
Chris Fullhart	*Layout Artist*
Dennis Sailsbury	*Photographer*

Address correction requested
P-208-9