THE UNIVERSITY OF UTAH

# NEWS

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**'SIMPLE EXPERIMENT' RESULTS IN SUSTAINED N-FUSION**
**AT ROOM TEMPERATURE FOR FIRST TIME**
**Breakthrough process has potential to**
**provide inexhaustible source of energy**

SALT LAKE CITY -- Two scientists have successfully created a sustained nuclear fusion reaction at room temperature in a chemistry laboratory at the University of Utah. The breakthrough means the world may someday rely on fusion for a clean, virtually inexhaustible source of energy.

Collaborators in the discovery are Dr. Martin Fleischmann, professor of electrochemistry at the University of Southampton, England, and Dr. B. Stanley Pons, professor of chemistry and chairman of the Department of Chemistry at the University of Utah.

"What we have done is to open the door of a new research area," says Fleischmann. "Our indications are that the discovery will be relatively easy to make into a useable technology for generating heat and power, but continued work is needed, first, to further understand the science and secondly, to determine its value to energy economics."

Nuclear fusion offers the promise of providing humanity with a nearly unlimited supply of energy. It is more desirable than the nuclear fission process used today in nuclear power plants. Fusion creates a minimum of radioactive waste, gives off much more energy and has a virtually unlimited fuel source in the earth's oceans.

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Nuclear fusion is also superior to traditional energy sources, such as coal, gas and oil, which can pollute the environment and eventually will be depleted. Using fusion for energy would reduce or even eliminate major causes of acid rain, the greenhouse effect and U.S. dependence on foreign oil.

Their findings will appear in the scientific literature in May.

Scientists worldwide have searched for more than three decades for the ability to create and sustain nuclear fusion reactions, which are thought to be the ideal energy source. In nature, the energy of stars, such as the sun, is supplied by nuclear fusion. All fossil fuels presently used on earth are simply storehouses of stellar nuclear fusion energy. Prior to the breakthrough research at the University of Utah, imitating nature's fusion reactions in a laboratory has been extremely difficult and expensive.

In the Utah research, the electrochemists have created a surprisingly simple experiment that is equivalent to one in a freshman-level, college chemistry course. Conventional nuclear fusion research requires temperatures of millions of degrees, like those found in the sun's interior, to create a reaction. The Utah research, however, creates the reaction at room temperature.

In the experiment, electrochemical techniques are used to fuse some of the components of heavy water, which contains deuterium and occurs naturally in sea water.

Sea water provides essentially an unlimited source of deuterium. Even though it is present at only one part in 38,000, one cubic foot of sea water contains enough deuterium to produce 250,000 BTU of energy, which is equivalent to the energy produced from 10 tons of coal.

The scientists know their experimental result is fusion in an electrode because the generation of excess heat is proportional to the volume of the electrode. "This generation of heat continues over long periods, and is so large that it can only be attributed to a nuclear process," Fleischmann says. "Furthermore, side reactions lead to the generation

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of neutrons and tritium which are expected by-products of nuclear fusion." The device the researchers have constructed produces an energy output higher than the energy input.

Pons calls the experiment extremely simple. "Observations of the phenomenon required patient and detailed examination of very small effects. Once characterized and understood, it was a simple matter to scale the effects up to the levels we have attained."

The researchers' expertise in electrochemistry, physics and chemistry led them to make the discovery. "Without our particular backgrounds, you wouldn't think of the combination of circumstances required to get this to work," says Pons.

Some may call the discovery serendipity, but Fleischmann says it was more accident built on foreknowledge. "We realize we are singularly fortunate in having the combination of knowledge that allowed us to accomplish a fusion reaction in this new way."

The idea to attempt the innovative experiment was seeded in the late 1960s when Fleischmann conducted research on the separation of hydrogen and deuterium isotopes. The results were odd. His interpretation of the data indicated it would be worth looking for nuclear fusion reactions.

Later, in separate research, Pons looked at isotopic separation in electrodes and was puzzled at certain results. The two pondered the data and later discussed the findings on two memorable occasions, once when they drove together through Texas and later when they took a hike up Millcreek Canyon on the outskirts of Salt Lake City.

"Stan and I talk often of doing impossible experiments. We each have a good track record of getting them to work," says Fleischmann. "The stakes were so high with this one, we decided we had to try it."

The research strategy was concocted in the Pons' family kitchen. The nature of the experiment was so simple, says Pons, that at first it was done for the fun of it and to

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satisfy scientific curiosity. "It had a one in a billion chance of working although it made perfectly good scientific sense."

The two performed the experiment and had immediate indication that it worked. They decided to self-fund the early research rather than try to raise funds outside the University because, says Pons, "We thought we wouldn't be able to raise any money since the experiment was so farfetched."

Working late into the night and on weekends at Pons' University of Utah laboratory, the two improved and tested the procedure throughout a five-and-a-half year period.

"We hope we'll be able to work with others to develop this into a useable technology for generating heat and power for the world," says Fleischmann. "The process is clean and indications are it will be economical compared to conventional nuclear systems."

Fleischmann has written more than 240 articles in the electrochemical, physics, chemistry and electrochemical engineering fields during his 40-year career, and is regarded as one of the leading electrochemists in the world. He is a fellow of the Royal Society of England. He was awarded a medal for Electrochemistry and Thermodynamics by the Royal Society of Chemistry in 1979; the Olin-Palladium Medal of the Electrochemical Society in 1985; and the Bruno Breyer award by the Royal Australian Chemical Society in 1988. He earned a doctorate in chemistry at London University in 1951.

He and Pons have collaborated on 32 articles.

Pons has authored more than 140 articles and lectured throughout the United States, Canada and Europe. He earned a bachelor of science degree at Wake Forest University, Winston-Salem, N.C., in 1965 and a doctorate at the University of Southampton, England, in 1979. He is originally from Valdese, N.C.

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Working on the project with the two scientists is University of Utah graduate student, Marvin Hawkins from LaJara, Colo.

The fusion technology is owned by the University of Utah which has filed patent applications covering the technology. Information about commercial aspects of the technology development can be obtained from Dr. Norman Brown, director of the University of Utah Office of Technology Transfer, 801-581-7792.

The researchers are grateful for the encouragement of the United States Office of Naval Research, their respective universities, families and colleagues.

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# Curriculum Vitae

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|---|---|
| Name: | Martin Fleischmann |
| Date of birth: | 29 March 1927 |
| Place of birth: | Carlsbad, Czechoslovakia |
| Nationality: | British |
| Education: | High School, Worthing, Sussex, England. 1939-1945<br><br>Imperial College, London 1945-1949<br>ARCS 1947<br>1st Class Honours Chemistry, 1948<br>Ph.D. London University, 1951. |
| Academic career: | 1950-1967<br><br>Successively Research Fellow and Imperial Chemical Industries Research Fellow at Kings College, University of Durham, Newcastle-upon-Tyne (now the University of Newcastle-upon-Tyne) then Lecturer and Reader in Physical Chemistry, University of Newcastle-upon-Tyne.<br><br>1967-1983<br><br>Professor of Electrochemistry at University of Southampton (Chair originally endowed by the Electricity Council).<br><br>1977-1982<br><br>Science and Engineering Research Council Senior Fellow<br><br>1983-present<br><br>Research Professor. Also part-time positions at Harwell and University of Utah.<br><br>FRS (1986) |
| Medals: | The Royal Society of Chemistry. Medal for Electrochemistry and Thermodynamics (1979)<br><br>Olin-Palladium Medal of The Electrochemical Society (1985).<br><br>Bruno Breyer Medal, Royal Australian Chemical Society (1988) |

Publications, Scientific Articles: 242

CURRICULUM VITAE

February 1989

B. Stanley Pons

Professor of Chemistry
University of Utah
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Birth Date: February 8, 1943

Education:

1961-1965 B.S. Wake Forest University, Winston-Salem, North Carolina
1965-1967 University of Michigan, Ann Arbor, Michigan
1976-1978 Ph.D. The University, Southampton, Hampshire, England

Positions:

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|---|---|
| 1967-1975 | Self Employed |
| 1978-1980 | Assistant Professor, Department of Chemistry, Oakland University. |
| 1980-1983 | Assistant Professor, Department of Chemistry, University of Alberta. |
| 1983-1986 | Associate Professor, Department of Chemistry, University of Utah. |
| 1986-present | Professor, Department of Chemistry, University of Utah. |
| 1986-present | Adjunct Professor, Department of Bioengineering, University of Utah. |
| 1988-present | Chairman, Department of Chemistry, University of Utah. |

Professional Memberships:

The American Chemical Society
International Society of Electrochemistry
The Electrochemical Society

National Service:

1988- Editorial Advisory Board, Langmuir

Publications, Scientific Articles: 145