CHEMISTRY

Reactions Occur in Ice

➤A NEW NOTE in the long-standing controversy concerning the possibility of life on Mars, as well as the origin of life on earth, was introduced in Washington, D.C., by a report that ice is a good place for many of the chemical reactions basic to life forms.

The finding applies not only to pre-life chemicals on earth and Mars, but could also have implications for safe storage of tissues and food at freezing temperatures.

"Keeping things frozen does not mean they will not deteriorate," Dr. Harvey E. Alburn of Wyeth Laboratories, Radnor, Pa., told SCIENCE SERVICE. He said the food industry was aware of the fact that chemical reactions continue even under freezing conditions, and that scientists were working to determine the reactions involved and to solve any resulting problems.

The types of chemical reactions known to occur at significant rates in ice now include hydrolysis, dehydration, peptide formation, oxidation and peroxide decomposition. With Dr. Norman H. Grant, also of Wyeth, Dr. Alburn found that chemical decomposition of hydrogen peroxide is faster in ice than in liquid water.

Drs. Alburn and Grant reported that the combination of limited movement and low temperature found in ice "fails to slow down a number of reactions of biochemical importance."

This could mean that even though water is present only as frost or ice, as is now believed the case on Mars, pre-living chemicals could be formed. It could also mean that such chemicals would have been formed on earth, if this planet actually had a low-temperature origin, as some scientists suggest.

The scientists note that one of the conditions deemed essential for forming pre-life compounds is a concentration of the required inorganic chemicals. The process of freezing could result in such a concentration.

They also note that in ice, newly formed chemical structures would probably be isolated from living organisms and might evolve into quite complex compounds.

They reported in Science 150:1590, 1965, that recent finding suggest the way chemical reactions take place may change on freezing, with the ice acting as a catalyst to speed up the reactions.

• Science News Letter, 89:38 January 15, 1966

PHYSICS

Waves Hit High Frequency

➤MICROWAVE RADIO WAVES of the highest frequency ever reported, 12 thousand million pulsations every second, have been produced in Cambridge, Mass, using "hot electrons."

To generate such high frequency microwaves, scientists used a thin crystal of gallium arsenide, a semiconductor now used in transistors and lasers. They applied a low voltage across the crystal, which is less than one-thousandth of an inch thick.

This converted direct current to continuous microwave power at frequencies as high as 12,000 megacycles, twice as high as previously achieved.

The experiments were conducted by scientists at the National Aeronautics and Space Administration's electronic research center under the direction of assistant director Dr. W. Crawford Dunlap.

Because microwaves can be aimed more precisely than radio waves of lower frequency, they are particularly useful for long distance communications. The high frequencies generated by using "hot electrons" appear promising for future spacecraft transmitters, since they would be more efficient for space communications than the lower frequencies now available.

Weak signals from space are difficult to process into any useful form without highly complex equipment. Most microwave transmitters are now of the vacuum type, because transistors produced at this time are inadequate for these frequencies.

If vacuum tubes can be replaced with crystals such as gallium arsenide, a significant improvement in space communication efficiency would be possible.

Achievement of the very high microwave frequencies resulted from experiments by Dr. Harold Roth and two associates, W. Deter Straub and John A. Ayer. Their work was based on the changes which "hot electrons" undergo in solid state semiconductors discovered by J. B. Gunn of International Business Machines Corporation.

"Hot electrons" are highly energetic particles not in equilibrium with their surroundings, raised to such a high energy level by the voltage applied across a gallium arsenide crystal. The energetic electrons give up energy in the high-frequency range to reach equilibrium with their surroundings.

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TECHNOLOGY

Flame Used as Amplifier To Produce Intense Sound

➤A FLAME can be used as an amplifier to produce intense sound.

Scientists at Stanford Research Institute, Menlo Park, Calif., have used such a "pyroacoustic" loudspeaker to amplify a human voice to a loudness many times over what is possible with electrodynamic loudspeakers of the same power.

Loud sound generators are needed, for instance, to test equipment exposed to jet engine noise. An extremely loud speaker also could be useful in disaster situations.

According to theory, a flame should be able to increase sonic energy from 10 to 100 times.

To verify the theory, a small prototype pyroacoustic loudspeaker was built at Stanford Research Institute under the direction of James Arnold. In this new system a stream of combustible gas is modulated as it passes through an opening formed by a metal block and the diaphragm of a conventional electromagnetic loudspeaker. The modulated gas stream expands through a throat and passes through a wire mesh flame holder.

The variation of the flame caused by the variations in gas flow gives differing mechanical energy to the gas molecules of the combustion products. Since large changes in molecular motion follow those of the loudspeaker, sound is amplified many times.

The gas can be any burnable mixture of hydrocarbons and air.

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OCEANOGRAPHY

New Ocean Data System Helps Collect Specimens

➤ DELICATE OCEANOGRAPHIC instruments can now be suspended at specific underwater depths to gather sea specimens or information about the ocean environment such as currents and temperatures.

By using an electronic system developed by Sylvania Electric Products Inc., scientists can launch instruments from aircraft, surface vessels or submarines to predetermined depths in the ocean. Here the instruments carry out prearranged experiments and return to the sea surface when tasks are completed.

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PHYSICS

Historical Cyclotron Moved to Smithsonian

➤ THE HISTORY-MAKING cyclotron at Columbia University that was used in the first atomic energy experiments in the United States 27 years ago has smashed its final atom.

The machine, which may be the oldest operating cyclotron in the world, is being dismantled and given to the Smithsonian Institution in Washington, D. C.

The atom-smasher is only 28 years old. It was used in January, 1939, in the experiments that split the uranium atom and recorded the release of its tremendous energy for the first time in the United States.

Later the same cyclotron was used to establish the first proof that the rare uranium 235 isotope, not the other more common uranium isotope, was the fissionable material. That proof opened the way to the United States' intense research effort during World War II that led to the creation of the atomic bomb and the development of atomic energy.

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