the superconductivity arena. When the new materials were announced at a recent special session of the American Physical Society, it touched off a wave of speculation on the revolutionary advancement that the materials would yield in smaller, faster electronic devices. It appears that the Bellcore researchers have taken a major step in bringing the superconductivity promise closer to reality.

John Rowell, a Bellcore research manager, said that Bellcore doesn't plan to patent the process since it has been used for some time to make thin-film deposits with other materials. Bellcore does plan to publish details of the process in an upcoming issue of Applied Physics Journal.

—*Larry Sarchin*

COMMUNICATIONS

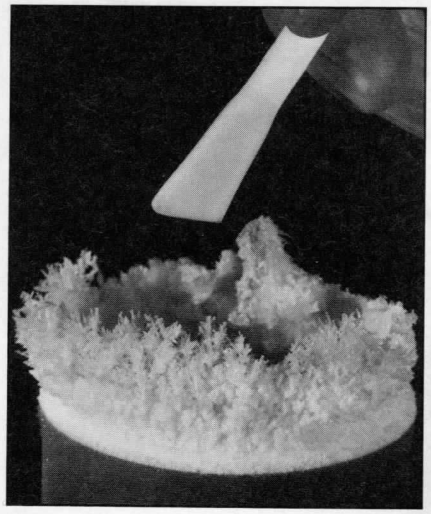
Fluoride Purity Increased By 90%

A new process for purifying the compounds used in fluoride glass may hasten the deployment of low-loss fluoride optical fiber in long-distance, repeaterless telecommunications systems. These high-purity fluoride fibers would allow information to be transmitted 20 times farther than is currently possible with silica-based fibers.

One of the factors hampering the development of such fibers has been the inability to remove impurities from compounds used in making fluoride glass. The existence of impurities diminishes the inherent ability of fluoride fibers to carry information long distances.

Scientists at GTE Laboratories, Waltham, Mass., say that with their new process, chemical vapor purification, the purity of zirconium fluoride has been increased by 90 percent, with results ranging from 99.999995 to 99.99999 percent pure. This is the highest purity level ever recorded for the compound, according to GTE. The new technique offers the potential for attaining purity levels of one contaminant part per trillion according to Robert Folweiler, the GTE researcher who developed the process.

The GTE process is similar to distillation in that chemical vapors react to separate desirable elements from contaminants. Beginning with a rolled cylinder of zirconium metal in a honeycomb configuration, a chlorinating agent is passed through the honeycombs, where it reacts with the metal to form zirconium chloride, a vapor. This vapor is then reacted with a fluorinating agent, forming ZrF_4, which precipitates out as a solid. "Because the zirconium chloride is pure, the zirconium fluoride is pure," said Richard Klein, manager of the optical technology department at GTE Labs.



GTE Laboratories' chemical vapor purification process produces crystalline particles of zirconium fluoride that are 90 percent purer than those made by current methods. When fully developed, fluoride optical fiber is expected to transmit information 20 times farther than is possible with present fiber.

Traditional processes dissolve the zirconium, separating out impurities in the liquid state, but the separation coefficients aren't very high, so the process must be repeated a number of times. "Theoretically you could continue the separation until you reach the desired purity," said Klein, "but in a practical sense you have to worry about contaminants, which are introduced in every cycle." The new vapor process involves only one cycle, thus ruling out recontamination.

"In contrast to currently used optical fiber which utilizes a repeater every 30 to 50 kilometers, fluoride fiber transmission links would need repeaters only every 200 to 1,000 kilometers," said Klein. This would reduce the number of repeaters in a fiberoptic link stretching between California and Hawaii from 40 to two.

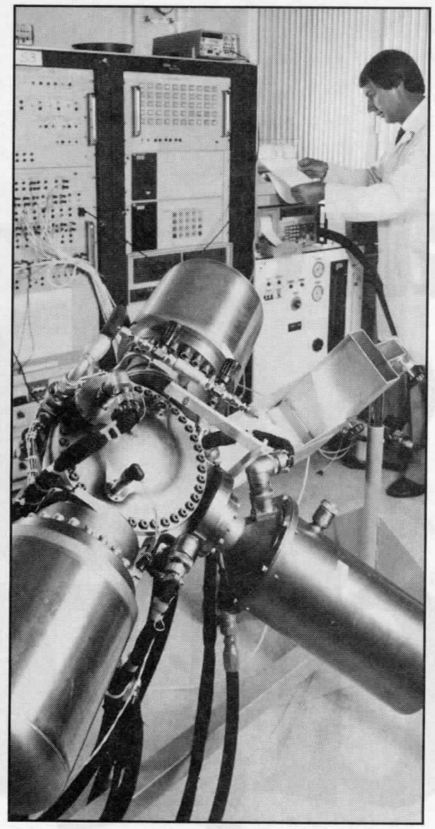
GTE was awarded a patent for the process in March of this year and is exploring commercialization through internal production or licensing agreements with other vendors. Current research is being done under contract to the Naval Research Laboratory, Washington D.C., which will work toward making fiber with the ZrF_4 glass.

—*Holly Bigelow*

TECHNOLOGY

Vuilleumier-Cycle Refrigerator Passes Test

A cryogenic cooler that could greatly extend the life and sensitivity of U.S. infrared detector satellites has completed an accelerated five-year test at Hughes Aircraft's Electro-Optical and Data Systems Group.



Hughes' Vuilleumier-cycle cryogenic cooler passed an accelerated five-year test to simulate space applications.

The Vuilleumier-cycle cooler can refrigerate infrared sensors to near absolute zero with low internal operating forces, reducing wear on bearings and seals. Its maintenance-free operation and cooling power make it ideal for space applications, although the cooler has not yet been tagged for a specific detector satellite program. The cooler, which has been operating in the laboratory for the past 2½ years at an accelerated rate to simulate five years in space, was funded by the Strategic Defense Initiative Organization.

"This test is significant because cryogenic coolers will be used in a number of large space systems," said Dr. Manos Vourgourakis, the program manager for the cooler project. "To our knowledge, this cooler is the only one of its type in the world that has performed this long at such low temperatures."

A detector satellite would be equipped with two such coolers. The backup cooler would be activated by a thermal switch if the main failed. Primary power for the coolers would be supplied by solar receiver panels, with a eutectic, or hot salt, solution supplying backup power when the satellite passed through the Earth's shadow. □