



*Robert H. Wentorf, Jr.*

## ROBERT H. WENTORF, JR.

*1926-1997*

BY ROBERT C. DEVRIES

ROBERT H. WENTORF, JR., retired staff scientist at General Electric Corporate Research and Development Laboratory, Schenectady, New York, and distinguished professor of chemical engineering at Rensselaer Polytechnic Institute, Troy, New York, died at his home in Easton, New York, of a heart attack on April 3, 1997.

Bob was born in West Bend, Wisconsin, on May 28, 1926, the only son of Robert Henry Wentorf, chief engineer and product designer for the West Bend Aluminum Company, and Sophia Rusch Wentorf. Bob showed strong interest in things mechanical and chemical even as a young boy. He graduated at the top of his class at Northwestern Military Naval Academy and then continued on at the University of Wisconsin, where he was in a U.S. Navy V-12 unit from 1944 to 1945 studying engineering fundamentals. He earned his B.S. degree in chemical engineering in 1948. In graduate school at Wisconsin, Bob switched to physical chemistry and earned his Ph.D. in 1952 with a thesis on critical phenomena in carbon dioxide and sulphur hexafluoride. At Wisconsin he met Vivian Marry, and they were married in 1949.

Bob joined the General Electric Research Laboratory (later GE Corporate Research and Development Center [CRD]) on December 31, 1951, and moved to Schenectady, New York, in 1952 where his creative genius flourished. He became a legend in his own time for his seminal accomplishments in the synthe

sis of diamond and other superhard materials under conditions of high temperature and pressure. At General Electric he was hired into a team that had been assembled for the express purpose of synthesizing diamond abrasive grain to become independent of foreign sources. He contributed to the design of apparatus, to the understanding of the chemistry of reactions pertinent to the synthesis of diamond, and to the reduction of the initial processes to production level. In 1957 he was the lone inventor of the process to convert the hexagonal form of boron nitride to a new phase, cubic boron nitride (trade name, Borazon), which is the second hardest material known and substitutes for diamond where chemical reactivity is a problem in grinding or cutting. These products created a new business for the General Electric Company, and the processes were copied throughout the world with the result that today 90 percent of industrial diamond is synthesized.

But the full impact of Bob's inventive genius was yet to be realized. He was the first to invent a process for growing large single crystals of diamond in a thermal gradient; this was brought to such success by others (colleagues Herb Strong, Roy Tuft, Bill Rocco) that synthesized gem-quality diamond is now sold for precision cutting tools, wire-drawing dies, windows, and anvils for high-pressure cells and is becoming a source of consternation to the gem industry. With Bill Rocco, Bob then developed a sweep-through process whereby diamond or cubic boron nitride grains could be sintered to make strong polycrystalline aggregates for cutting tools, drill bits, and wire-drawing dies that have revolutionized these applications. Such compacts could not be found in nature with the controlled properties necessary for numerous machining and drilling tasks. So of the principal products from the synthetic superhard materials industry throughout the world, namely, abrasive grain (diamond and boron nitride), single crystals, polycrystalline sintered bodies, Bob Wentorf alone is responsible for cubic BN, and almost single-handedly for the latter two besides contributing to the original synthesis of diamond. These contributions are described in forty-three published papers and forty-four patents. His definition of research is often quoted: "One of our jobs is to make mistakes as

fast as we can, but never make the same mistake twice." In fact, he rarely did the same experiment twice, but he was formidable in gleaning the maximum information from each.

For these accomplishments Bob received the American Chemical Society's Ipatieff Prize in 1965, the American Society for Metals' Engineering Materials Achievement Award in 1973, Eastern New York Patent Law Association's Inventor of the Year Award in 1975 (with Rocco), the American Physical Society's International Prize for New Materials in 1977 (with his colleagues in the high pressure team), the Industrial Research Institute's Achievement Award in 1977, and three IR-100 awards. In 1986 Bob received the Man-of-the-Year Award of the Abrasive Engineering Society for outstanding contributions to abrasives and grinding technology and was specifically cited for his invention and development of Borazon. From 1966 to 1967 he was teaching a course in solid-state physics at the University of Wisconsin as the Brittingham Visiting Professor of Chemistry and Chemical Engineering.

He was elected to Coolidge Fellowship, the highest award of the General Electric CRD Center, in 1972, and to the National Academy of Engineering in 1979, where his citation was "For discoveries and inventions in superpressure technology leading to new materials, knowledge, and products and processes." He received an honorary doctor of science degree from his alma mater in 1981. He was a member of the American Chemical Society, Sigma Xi, American Association for the Advancement of Science, Tau Beta Pi, and Phi Kappa Phi honorary.

Besides high-pressure/high-temperature science and engineering, Bob had numerous other missions. During his retirement he taught both undergraduate and graduate courses at Rensselaer Polytechnic Institute as distinguished professor of chemical engineering. He was also much concerned with population control, energy, and farmland conservation. He studied photochemical reactions and their relation to synthetic fields, analyzed the use of solar energy and alternative fields, and experimented in his own home with a pool for heat storage. He experimented with good farming procedures on his farm and was a member of the Agricultural Stewardship Association and

the Easton Planning Board in the area in which he lived as well as the nationally known American Farmland Trust. He served as clerk of the Easton Monthly Meeting of Friends.

Bob was also a soaring pilot, mechanic, outdoorsman, skier, swimmer, humorist, patron of the arts, and a gentle human being whose awareness and concern for the human condition on this earth were infectious and influential. He pursued all these endeavors with enthusiasm, humor, and competence. His synthesis of diamonds from one of his favorite foods, peanut butter (news item: "Diamond directly from *Arachis Hypogaea*"), probably did more to popularize the accomplishment than all the subsequent papers and ads. While eating peanut butter and crackers at lunch with Bob, one might have the privilege of his reading aloud from archy and mehitabel or Pogo, which were among his favorites for humor and philosophy. We did phase equilibria and crystallization of chocolate (another favorite food) in the same freezer in which he had stored a road-killed ermine retrieved during his bike ride to work. Bob liked to show his prize until it was discovered by the local safety inspector who happened on it and didn't see it in the same light as Bob.

He was totally unafraid of fixing anything mechanical and repaired all of his farm equipment including taking tractors apart. He and his colleague, F.P. Bundy, converted an old Pontiac station wagon into a winch tow for launching gliders, and then they instructed new pilots. In the early days of hi-fi, he converted one end of his living room at home into a gigantic speaker to capture those low frequencies. Bob and his colleague, Herb Strong, swam many miles together in a regular exercise routine. Bob analyzed swimming as he did any problem to maximize his efficiency and pleasure. He died swimming in a pool of his own design in a new home incorporating many of his own ideas for energy conservation. I believe he would qualify for Sir Kenneth Clark's category of "God-given geniuses with whom we are occasionally blessed."

Bob is survived by a son, Rolf C. Wentorf; two daughters, Jill W. Wright and Laine W. Hills; a sister, Phyllis Nelson; and three grandchildren, Jessa Hills and Catherine and Christopher Wright. Both his first wife, Vivian Marty Wentorf, and his second

wife, Frances Gillespie Wentorf, whom he married in 1993, are deceased.