

OBITUARIES

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Jacques Isaac Pankove

Jacques Isaac Pankove, one of the great 20th-century innovators in materials science and semiconductors, died in his home in Princeton, New Jersey, on 12 July 2016.

Jacques was born in Chernihiv, Ukraine, on 23 November 1922. A year later he and his family immigrated to Constantinople, and the following year they moved to Marseilles, France. After the Nazis occupied the city in 1942, he and his family immigrated to the US and settled in Oakland, California. He attended the University of California, Berkeley, where he received his BS in 1944 and his MS in 1948, both in electrical engineering. Between getting the two degrees, Jacques enlisted in the US Army Signal Corps and served in the Philippines. He earned his PhD from the University of Paris in 1960 for his work on IR emission in germanium.

From 1948 to 1970, Jacques was a member of the technical staff at RCA Laboratories in Princeton, and he was an RCA fellow from 1970 to 1985. Among the seminal contributions he made while there were prototypes of the first commercial transistor, the first gallium arsenide IR LED, and the first gallium arsenide phosphide visible injection laser. Most notably, he pioneered the semiconductors based on the gallium nitride family and in the 1970s was the first to develop a GaN blue LED. In that decade he studied most of the physical properties of GaN, and his works helped launch the worldwide scientific exploration of its family of semiconductors for the next 30 years. That research has led to novel devices with multiple applications in such areas as solid-state lighting, information storage, and high-power and high-frequency electronics.

Among the awards Jacques received for those discoveries were IEEE's J. J. Ebers Award in 1975, the 1998 Rank Prize in Optoelectronics, and the Distinguished Engineering Alumni Award from Berkeley in 2000. In 1997 the Materials Research Society dedicated its fall symposium on nitride semiconductors to him.



Jacques Isaac Pankove

When RCA decided to terminate the GaN program in the mid 1970s, Jacques redirected his energy and creativity to the fields of amorphous and crystalline silicon. Among his many contributions to those fields are his detailed investigations of the role of hydrogen in the materials; in particular, he discovered in the early 1980s how hydrogen deactivates p-type dopants in crystalline Si. Ten years later researchers discovered that deactivation of p-type dopants in GaN by hydrogen was responsible for the difficulty in generating p-type conductivity in it. Resolving that problem and employing improved heteroepitaxial techniques led to the first efficient blue LED by Shuji Nakamura and the device's subsequent commercialization by Nichia Corp.

Jacques was a Visiting MacKay Lecturer at Berkeley in 1968–69, a visiting professor at the University of Campinas in Brazil in 1975, and a Distinguished Visiting Professor at the University of Missouri in 1984. From 1985 until his retirement in 1993, he was the Hudson Moore Jr Endowed Chair in the electrical and computer engineering department at the University of Colorado Boulder with a joint appointment as a distinguished scientist at the National Renew-

able Energy Laboratory in Golden. At Boulder, in revisiting GaN, he invented the high-gain SiC/GaN heterojunction bipolar transistor, with good performance up to 500 °C. Later, as a professor emeritus, he founded the research company Astralux, where he continued to develop the transistor and other potential applications of GaN.

A prolific inventor, Jacques had more than 90 US patents. In 1962 he made an educational film called *Energy Gap and Recombination Radiation*. In 1971 he wrote the classic textbook *Optical Processes in Semiconductors* (Dover). Additionally, he served as an editor of several influential books, including two volumes—*Electroluminescence* (1977) and *Display Devices* (1980)—of Springer's Topics in Applied Physics series, and was a member of the editorial boards for several research journals.

Jacques was a passionate teacher who was insatiably curious and creative. When not teaching or writing, he loved being active; he could be found playing tennis, skiing, hiking, gardening, or working on a home-improvement project. He was a generous supporter of the arts in Princeton and enjoyed taking painting, sculpture, and print-making classes. He is deeply missed by his family, friends, and colleagues across the world.

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