Compound Semiconductor Materials and Devices: How We Got Here and Where We Might Be Going, Jerry Woodall

Well, to paraphrase an old misogynist commercial, as applied to compound semiconductors, "You've come a long way baby". This talk will be a cursory and necessary biased review of how compound semiconductor materials and devices actually amounted to something. I will focus on the roles of heterojunctions and solving surface and interface issues in this continuing success story. And, what about nano technology? Truthfully, I think nothing notable will happen in the world of commercially important technology in my lifetime.

Jerry M. Woodall, A National Medal of Technology Laureate, and the C. Baldwin Sawyer Professor of Electrical Engineering at Yale University, received a B.S. in metallurgy in 1960 from MIT. In 1982, he was awarded a Ph.D. in Electrical Engineering from Cornell University. Early in his career, he developed both high purity gallium arsenide (GaAs) crystals, used for the first definitive measurement of fundamental carrier transport in GaAs, and highly perfect GaAs crystals used to fabricate the early injection lasers. He then pioneered and patented the development of GaAs high efficiency IR LEDs, used today in remote control and data link applications such as TV sets and IR LAN. This was followed by the invention and seminal work on gallium aluminum arsenide (GaAlAs) and GaAlAs/GaAs heterojunctions used in super-bright red LEDs and lasers used, for example, in CD players and short link optical fiber communications. He also pioneered and patented the GaAlAs/GaAs heterojunction bipolar transistor used in, for example, cellular phones. His demonstration of the GaAlAs/GaAs heterojunction led to the creation of important new areas of solid-state physics, such as: superlattice, low dimension, mesoscopic, and resonant tunneling physics. Also, using the technique called molecular beem epitaxy (MBE) and the GaAs/InGaAs strained, non-lattice-matched heterostructure, he pioneered the "pseudomorphic" high electron mobility transistor (HEMT), a state-of-the-art high speed device widely used in devices and circuits including those found in cellular phones. This work led to the use of the pseudomorphic InAs/GaAs heterostructure to make "self-organized" quantum dots, a currently popular topic in physics. His present work involves the MBE growth of III-V materials and devices with special emphasis on metal contacts, the thermodynamics of extremely large doping concentrations, and devices made of non-lattice matched heterojunctions and substrates.

His efforts are recorded in over 320 publications in the open literature, and 67 issued U.S. patents. His accomplishments have been recognized by his election as IBM Fellow in 1985, by five major IBM Research Division Awards, 30 IBM Invention Achievement Awards, and an $80,000 IBM Corporate Award in 1992 for the invention of the GaAlAs/GaAs heterojunction, and, most recently, President Bush awarded Prof. Woodall the 2001 National Medal of Technology.

Other recognition includes 9 NASA certificates of recognition, a 1975 IR-100 Award, the 1980 Electronics Division Award of the Electrochemical Society (ECS), the 1984 IEEE Jack A. Morton Award, the 1985 ECS Solid State Science and Technology Award, the 1988 Heinrich Welker Gold Medal and International GaAs Symposium Award, the 1990 American Vacuum Society (AVS) Medard Welch (Founder's) Award, its highest honor, the 1997 Eta Kappa Nu Vladimir Karapetoff Eminent Members' Award, the 1998 American Society for Engineering Education's General Electric Senior Research Award, the 1998 Electrochemical Society's Edward Goodrich Acheson (Founder's) Award, its highest honor, an IEEE Third Millennium Medal (2000) and the Federation of Materials Societies' 2002 National Materials Advancement Award. Honorific recognition includes his election to the National Academy of Engineering in 1989, Fellow of the American Physical Society in 1982, IEEE Fellow in 1990, ECS Fellow in 1992, and AVS Fellow in 1994. His national professional society activities include President of the ECS (1990), President of the AVS (1998-1999).