NICK HOLONYAK, JR.

Nick Holonyak, Jr. was born Nov 3, 1928 in Zeigler, IL and received B.S. (1950), M.S. (1951), and Ph.D. (1954) degrees in EE at the University of Illinois. He was John Bardeen's first student and held a TI fellowship. He worked at Bell Telephone Laboratories (1954-55) and, after military service, at GE (Syracuse, 1957-63) before returning in 1963 to the University of Illinois as a professor. He is John Bardeen Chair Professor of Electrical and Computer Engineering and Physics, and ECE Professor in the Center of Advanced Study.

He is an early contributor (1954-60) to diffused-impurity oxide-masked silicon device technology (transistors, p-n-p-n switches, and thyristors). He is the inventor (1958) of the shorted emitter used in thyristors and symmetrical switches (TRIACs), including the basic element in the wall light dimmer. He is the first to make silicon tunnel diodes and observe phonon-assisted tunneling (1959), the first observation of inelastic tunneling and the beginning of tunneling spectroscopy. He invented (1960) closed-tube vapor phase epitaxy of III-V semiconductors, the forerunner of all present-day III-V VPE crystal growth. Besides early work (1960-62) on III-V heterojunctions, he was the first (1960) to grow $GaAs_{1-x}P_x$ (an alloy) and to construct visible-spectrum lasers and light emitting diodes (1962), thus proving that III-V alloys are "smooth" and viable, in general, for use in optoelectronic devices. He is the inventor of the first practical LED, the red $GaAs_{1-x}P_x$ LED, which also marks the beginning in the use of III-V alloys in semiconductor devices, including in heterojunctions and quantum well heterostructures (QWHs). Besides demonstrating the visible-spectrum laser operation of the alloys GaAsP (1962), InGaP (1970), AlGaAsP (1970), and InGaPAs (1972), he and his student Rezek made (via LPE, 1977) the first quantum well (QW) laser diodes. Later, with Dupuis (and MOCVD AlGaAs-GaAs), he demonstrated (1978) the inital continuous 300 K operation of a QW laser, and introduced the name "quantum well laser". He and his students introduced (1980) impurity-induced intermixing (~ 600°C) of QW heterostructure (QWH) and superlattice layers, and with it the selective shift from QW lower gap to bulk-crystal higher gap (used to define waveguide and

laser geometries). In 1990 he and his students introduced the Al-based III-V native oxide into optoelectronics, including its use as a buried oxide aperture to define the current and cavity in lasers (now used in VCSELs). He is currently concerned with coupled quantum-dot/quantum well-lasers. His work has led to 500+ papers and 31 patents.

Holonyak is a member of NAE (1973), NAS (1984), American Academy of Arts and Sciences (Fellow, 1984), Russian Academy of Sciences (Foreign Member, 1999), American Physical Society (Fellow), Institute of Electrical and Electronics Engineers (Life Fellow), Optical Society of America (Fellow), Am. Assoc. Adv. Science (Fellow), Electrochemical Society, and Mathematical Association of America. He has received a number of awards, including: Cordiner Award (1962, GE); Morris N. Liebmann Award (1973, IEEE); John Scott Medal (1975, City of Philadelphia); Gallium Arsenide Symposium Award with Welker Medal (1976); Jack A. Morton Award (1981, IEEE); Solid State Science and Technology Award (1983, Electrochemical Society); Monie A. Ferst Award (1988, Sigma Xi); Edison Medal (1989, IEEE); National Medal of Science (1990, U.S.); Charles H. Townes Award (1992, OSA); Honorary Member of the Ioffe Physical-Technical Institute (1992, St. Petersburg); Honorary Doctor of Science (1992, Northwestern University); NAS Award for the Industrial Application of Science (1993); ASEE Centennial Medal (1993); American Electronics Association 50th Anniversary Award (1993); Vladimir Karapetoff Eminent Members' Award of Eta Kappa Nu (1994); Honorary Doctor of Engineering (1994, Notre Dame); TMS John Bardeen Award (1995, The Minerals, Metals, and Materials Society); Japan Prize (1995); Eminent Member of Eta Kappa Nu (1998); Distinguished Alumnus of Tau Beta Pi (1999); IEEE Third Millennium Award (2000); Frederic Ives Medal of the Optical Society of America (2001); Global Energy International Prize (Russia, 2003); and IEEE Medal of Honor (2003).

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