

## Achievement Award

The Achievement Award is the highest award given by the Society of Women Engineers. It is presented annually to a woman who has made an outstanding contribution in a field of engineering, has academic training in either science or engineering, and meets the requirements for Senior Member in the Society.

The main criteria for selection is based on the significance of the achievement cited on her behalf and on the sustained contributions, of the candidate, to the field of engineering. The contributions can be in design, production, management, education, or research, or any phase of engineering.



Manijeh Razeghi, Ph.D.  
Northwestern University

*“For leadership and contributions to optoelectronic device research and education.”*



1995

**MANIJEH RAZEGHI**

*For leadership and contributions to optoelectronic devices research and education.*

**ACHIEVEMENTS** - Initiated the design and implementation of epitaxial growth techniques such as metalorganic chemical vapor deposition (MOCVD) and metalorganic molecular beam epitaxy (MOMBE). Developed a number of semiconductor structures for advanced photonic and electronic devices. Pioneered the growth of (Ga,In)(As,P) based heterostructures overcoming numerous material problems. Holds 32 patents.

**CONTRIBUTIONS** - Coeditor, *Journal of Applied Physics A*. Chair, SPIE Symposium on “Physical Concepts of Materials for Novel Optoelectronic Device Applications.” Editorial board member, *Semiconductor Science and Technology*, *The Journal of Optoelectronics*, and *SPIE Press*.

**HONORS** - IBM Europe Science and Technology Prize.  
**EDUCATION** - Ph.D. in Physics, University of Paris. Ph.D. in Materials Science, University of Paris.



## Achievement Award

### Manijeh Razeghi, Ph.D.

The 1995 Society of Women Engineers (SWE) Achievement Award recipient is Dr. Manijeh Razeghi. Dr. Razeghi is the Walter P. Murphy Professor of Electrical Engineering and Computer Science, and Director, Center for Quantum Devices at Northwestern University, Evanston, IL. This Center consists of 40 professional scientists and graduate students with the responsibility for the development of technologies in the area of optoelectronics. The Center develops new quantum photonic and electronic devices such as lasers, photodetectors, modulators and transistors, and assembles them into novel optoelectronic integrated circuits.



Dr. Manijeh Razeghi

Dr. Razeghi received Ph.D. degrees in both Physics and Materials Science from the University of Paris. Formerly, she was Professor of Solid State Physics and Head of Solid State Physics Laboratory, Teheran University, as well as Head of exploratory materials laboratory, Thompson-CSF Central Research Laboratory, Orsay, France. She is one of the leading researchers in the field of optoelectronics. Her areas of expertise are in the growth and characterization techniques of III-V and II-VI semiconductor heterojunctions, multiple quantum wells and superlattices for photonic and electronic devices. She initiated the design and implementation of epitaxial growth techniques such as metalorganic chemical vapor deposition (MOCVD) and metalorganic molecular beam epitaxy (MOMBE). She has developed a number of semiconductor structures used in advanced photonic and electronic devices which are in turn used in fiber optics communications and many other applications.

Most significantly, Dr. Razeghi has pioneered the growth of (Ga,In)(As,P) based heterostructures overcoming numerous material problems that had frustrated many other researchers. (Ga,In)(As,P) has proven to be of particular strategic importance as a robust and powerful alternative to GaAs-AlGaAs for devices with improved performance and reliability. The growth of this sophisticated quaternary material system requires that critical issues such as crystal quality, optical properties and composition control be addressed. The driving force of Dr. Razeghi's work has been the reliable growth of high quality phosphorus-based materials for low-dimensional electronic, photonic and optoelectronic integrated circuits devices. It is through Dr. Razeghi's work that these materials systems and MOCVD have developed as a technique of choice for industrial mass production as well as cutting edge research.

Dr. Razeghi's efforts are almost legendary at this point and it is difficult to list all of her contributions and achievements with a catalogue of firsts of new materials, highest mobilities, sharpest interfaces and new devices. Dr. Razeghi has been described as "a Madonna of MOCVD...producing material miracles" due to her ability to "achieve astonishing brilliant results with MOCVD technology." Dr. Leo Esaki, Nobel Prize Laureate of Physics, described Dr. Razeghi as "the Queen of MOCVD."

Since joining Northwestern University, Dr. Razeghi has made important advances in the growth of (Ga,In)(As,P) for low threshold, high power lasers. She has also made a major contribution in growing new compounds for long wavelength applications, InTlSb, and short wavelength applications, III-Nitride. These results have yet again proved to be unique and the best in the world. In addition to Dr. Razeghi's research she has been responsible for educating a large number of students and researchers through a strong commitment to teaching. Generations of "students" - undergraduate, graduate, postdoc and visitors - all are being influenced by her philosophy and approach to work. Dr. Razeghi has a unique ability to do both cutting edge research and to educate future researchers.

Dr. Razeghi's work is well recognized by the scientific and technical community. She was awarded the prestigious IBM Europe Science and Technology Prize in 1987, being cited "for outstanding work in the production of material using metalorganic chemical vapor deposition techniques." She is the author of *The MOCVD Challenge* the definitive work on the subject and used by many of the leading scientists in the field. As Dr. Pierre Aigrain wrote in the Foreword to *The MOCVD Challenge: Volume 1*, "Needless to say, when one of the Queens writes as thorough a treatise on this very subject, this is bound to become a major event. At a time when, at last, III-V compounds, mostly InP (covered in volume 1) and GaAs (covered in volume 2) based materials, are becoming of major importance to industry; this treatise will be a must for every scientist and engineer in the field. Manijeh Razeghi has been recognized all over the world for her ability to achieve astonishingly brilliant results with MOCVD technologies. Simply reading the book may not be quite enough for every engineer to do fully as well as she does. But it is a necessary step in that direction." Furthermore, she is the author and co-author of more than 600 papers.

Dr. Razeghi has been awarded 32 patents most recently for "Large Waveguide Separate Confinement Quantum Well Laser Diodes for High Power Laser" and "Aluminum Free 650nm to 1100nm High Power Lasers Grown on GaAs, InP, and Si Substrates." She organized and chaired numerous international conferences. She is the co-editor of the *Journal of Applied Physics A* and a member of the editorial board of *Semiconductor Science and Technology*, *The Journal of Optoelectronics* and the SPIE Press Editorial Advisory Board.

As the forty-fourth recipient of the SWE Achievement Award, she is cited for leadership and contributions to optoelectronic devices research and education.