ENI AWARD 2019

Energy Frontiers

Roy Gordon

Winner

Organic Aqueous Flow Battery for Massive Electrical Energy Storage

Biography

Roy G. Gordon was born in 1940 in Akron, Ohio, USA, a grandchild of immigrants from Eastern Europe. He earned a Bachelor's degree in Chemistry and Physics at Harvard College in 1961, a Master of Science in 1962 and a PhD in 1964 in Chemical Physics under the supervision of John van Vleck. He was selected as a Harvard Junior Fellow, allowing him to continue his theoretical research at the University of Toronto with Harry Welsh and then at the University of Brussels with Ilya Prigogine. He was appointed to the faculty at Harvard University in 1966, where he is now the Cabot Professor of Chemistry.

Professor Gordon has held distinguished visiting professorships in theoretical chemistry at Berkeley (1969), Wisconsin (1970), Yale (1973), and Paris (1980). He has received a Sloan Foundation Fellowship, the American Chemical Society's Award in Pure Chemistry for 1972, its Baekeland Award for 1979, its Esselen Award for 1996, the Bourke Award of the Faraday Society, and Israel's Einstein Fellowship for 1984. He won an R & D 100 Award in 1991. He was an editor of the Journal of Chemical Physics and of Chemical Physics Letters. He was elected to the National Academy of Sciences in 1975, the American Academy of Arts and Sciences in 1976, the European Academy of Arts, Sciences and Humanities in 1984, and is a fellow of the American Chemical Society and the American Physical Society, and was chairman of its Division of Chemical Physics. His work on energy-conserving windows is featured in the permanent exhibit of the Corning Museum of Glass.

Gordon has made many notable advances in both theoretical and experimental physical sciences. Professor Gordon invented a number of materials and processes for their production, patented them, licensed them to industry and worked closely with them to transfer and adapt the techniques to the needs of industry. These processes are now the basis for billions of dollars of new products that have resulted from his effective transfer of technology from his laboratory to industry.

(1) Energy-Conserving Windows. He invented a structure (multilayers of tin oxide and silica) and process (a chemical vapor deposition method) now used world-wide by the glass industry for production of energy-efficient window coatings. These coatings are saving billions of gallons of heating oil (or its energy equivalent) every year.

(2) Solar Cells. He helped the solar cell industry to adopt his tin oxide coatings for thin-film photovoltaic cells that convert sunlight directly to electricity. Solar cells made from amorphous silicon, cadmium telluride or copper indium selenide use this technology.

(3) Diffusion Barriers for Interconnections in Microelectronics. A CVD process discovered by Gordon's research group is now used to form thin barrier layers of titanium nitride that prevent metals (Cu and Al) from diffusing out of the i micro-circuits on a chip and disrupting its transistors.

(4) Durable Electroluminescent Displays. Electroluminescent displays are widely used for backlighting displays in handheld microelectronic devices, cars and signs. Aluminum nitride layers, deposited by a process he discovered, protect these displays from water vapor.

(5) Improved Computers. As the semiconductor industry squeezes more bits into memory chips and increases the speed of transistors, electrical insulators with higher dielectric constant are needed. He discovered a method that is highly suitable for depositing such materials, and it has been widely adopted in the semiconductor industry.

(6) Optical Filters. Interference filters are widely used in modern technology. These multilayer structures require increasingly rigorous control over the thickness and uniformity of the layers. His process for vapor deposition of silica nanolaminates is now used in the commercial production of optical filters.