Mechanical Engineering
Academy of Distinguished Alumni

John B. Goodenough, Ph.D.

Honorary Mechanical Engineer, 2012

BA, Mathematics, Yale University, 1943
MS, Physics, The University of Chicago, 1951
Ph.D., Physics, The University of Chicago, 1952

Virginia H. Cockrell Centennial Chair in Engineering
The University of Texas at Austin

John Bannister Goodenough is known for his insights into the d-electron behavior of transition-metal solids. In the 1950s, he identified structural transitions in transition-metal oxides induced by cooperative d-orbital ordering; he used this insight to enable the ferrimagnetic memory elements of the first random-access memory (RAM) of the digital computer and also to develop the Goodenough-Kanamori rules for the sign of the interatomic spin-spin interactions of magnetic materials. In the 1960s, he demonstrated the chemical origin of the d-electron interactions in transition-metal oxides to clarify where those ceramics would be metallic and were magnetic insulators, as well as the phenomenon of single-ion magnetic anisotropy.

The oil crisis of the 1970s turned his attention to materials for energy conservation and storage of electric power in rechargeable batteries, which led to his oxide cathodes for Li-ion rechargeable batteries that have enabled the wireless revolution and the advent of the hybrid electric road vehicle. Since 1986, he has studied ionic conductivity in ceramics, polymers, and a glass for rechargeable batteries; he has demonstrated dendrite-free plating of alkali-metal anodes as well as stable catalytic activity at oxygen electrodes, and he has returned to the study of the variety of physical properties imparted to transition-metal oxides by d-electrons at the crossover from localized to itinerant behavior, including high-temperature superconductivity, colossal magnetoresistance, and charge-density waves.

Goodenough received a BA in mathematics from Yale University in 1943 (Class of 1944) while serving as a meteorologist in the USAAF during World War II; he obtained an MS and Ph.D. in physics from The University of Chicago in 1951 and 1952.

From 1952 to 1976, he was a research scientist and group leader at the MIT Lincoln Laboratory. In 1976, he accepted an appointment as professor and head of the Inorganic Chemistry Laboratory in Oxford, England; and facing retirement in England in 1986, he accepted the Virginia H. Cockrell Centennial Chair in Engineering at The University of Texas at Austin.

Professor Goodenough is a member of the U.S. National Academies of Engineering, Sciences, and Inventors; a Foreign Associate of *L'Academie des Sciences de L'Institut de France*, *Academia de Ciencas Exactas*, *Fisicas y Naturales* of Spain, and the Royal Society (UK). His Awards include Laureate of the Japan Prize, 2001; the Presidential Enrico Fermi Award, 2009; the National Medal of Science, 2012; the Charles Stark Draper Prize of the National Academy of Engineering, 2014; the Eric and Sheila Samsun Prime Minister's Prize for Innovation in Alternative Fuels for Transportation in 2015; and the Robert A. Welch Award in Chemistry (2017).

His publications include *Magnetism and the Chemical Bond* (1967), *Les oxydes des mėtaux de transition* (1973), *Witness to Grace* (2008), *Solid Oxide Fuel Cell Technology: Principles, Performance, and Operations* (2009, with Kevin Huang), 94 book chapters and reviews, and over 850 journal articles.