Princeton University

Honors Faculty Members Receiving Emeritus Status

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The biographical sketches were written by colleagues in the departments of those honored.

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Sigurd Wagner

From childhood on, Sigurd Wagner, professor of electrical engineering, has been fascinated by how things work, and how to make them work. His passion made him a pioneer in photovoltaics and flexible electronics. He conveyed this passion to the more than a hundred undergraduate researchers and over 40 Ph.D. students who worked in his laboratory. He has been instrumental in building Princeton's strength and reputation in solid-state electronics. Sigurd will retire on September 1, 2015.

At the age of 16, Sigurd had a brush with electrical engineering when he made a miniature radio of an earphone and a germanium diode, for prohibited post-bedtime listening in boarding school. But it was an extracurricular chemistry laboratory in high school that got him hooked on experiments. The laboratory, installed in a vaulted room of a baroque monastery, made him decide to study chemistry at the University of Vienna instead of accepting a fellowship for studying nuclear physics in Moscow. In 1968, he earned a Ph.D. in physical chemistry with research on gas molecules in vapors produced at very high temperature. Skipping a special award ceremony for top academic performance, he left Austria for a postdoctoral fellowship in the New World, at Ohio State University, where he continued doing research with high-temperature mass spectrometry.

A chance encounter with a recruiter from the Bell Telephone Laboratories led Sigurd to join its location at Murray Hill, New Jersey, in 1970. That began his transformation into an electrical engineer, which he considers incomplete, and a habit of getting into a new research field in each fresh decade. At Bell Labs, he first worked on the now all-important interface between silicon and silicon dioxide, and soon on its application to the development of a kilobit semiconductor memory. After moving to Bell Lab's Holmdel location, he became interested in making devices of chalcopyrite-type semiconductors. That led to the invention of several solar cells, notably

the copper indium selenide solar cell, a now-prominent thin-film solar cell. At the time, he was proud of having invented two of the world's four efficient solar cells.

Interested in the opportunity of building a new research organization from scratch, in 1978 he accepted the offer to become the chief of the photovoltaics research branch of the newly founded Solar Energy Research Institute (now the National Renewable Energy Laboratory) in Golden, Colorado. There he helped convert a horse pasture to a national laboratory. While he enjoyed the challenges of building a new organization and managing it, a workshop with a dozen eminent researchers reminded him of his first love: figuring out how things work, and how to make them work. Having experienced industrial and government laboratories, he resolved to explore an academic position.

In 1980, Sigurd arrived at Princeton. He was attracted by Princeton's reputation as a republic of scholar-teachers. He was persuaded by Princeton's singular attributes over alternatives: private, small, enabling a short commute. He was, and still is, impressed by Princeton's speed in making intelligent decisions, and by its lack of administrative barriers. What he did not fully appreciate was the immense pleasure of working with outstanding colleagues and students, and the astonishing ease of entering productive collaborations. These attributes of Princeton made him stay.

While Sigurd came to conduct research and to teach, he also took up the mission of rebuilding Princeton's strength in solid-state electronics. He helped this section of the Department of Electrical Engineering attain an outstanding national and international reputation. A hands-on semiconductor fabrication lab that he developed has for 25 years been taken by every sophomore in electrical engineering at Princeton, and by many undergraduate summer researchers and Ph.D. students. Alumni rate the lab as the best in their entire curriculum. He has a long history of encouraging women to pursue careers in science and engineering. Over the past decade, his research group, from undergraduate research advisees to postdocs, has been about 50 percent women, at least double the department average, and former members are now themselves faculty on three continents.

When working on hydrogenated amorphous silicon in the 1980s, Sigurd discovered the defect pool, a subtle but conceptually important manifestation of thermodynamic equilibration in an amorphous material. Later on, with fundamental experiments conducted in the 1990s, he helped lay the foundations of flexible electronics. By wrapping thin-film transistors of amorphous silicon on a metal foil around a pencil, he presented the forerunner of today's curved display screens. The discovery of elastically stretchable electrical conductors, made in his laboratory in the early 2000s, enabled making skin-like electronics. By virtue of their mechanical and electrical biocompatibility, such devices are beginning to add a new research dimension to neuroscience, and they raise hopes for clinical advances in the restoration of neural functions. In the current decade, the 2010s, he has enjoyed unique research collaborations with his colleagues James Sturm and Naveen Verma. By ranging from materials to systems, this joint enterprise is laying the broad foundation for advanced high-performance electronic surfaces.

Sigurd Wagner is widely considered the father of the field of flexible and stretchable electronics. Award citations speak of "groundbreaking research, both fundamental and applied, on amorphous semiconductors as well as chalcopyrites" (2009 Sir Nevill F. Mott Lecture Award, 23rd International Conference on Amorphous and Nanocrystalline Semiconductors) and "pioneering research on flexible and stretchable large-area electronics, and comprehensive study of the mechanical behavior of the same, which will be applied to various products in the near future" (2014 International Thin-Film Transistor Conference, 10th Anniversary Prize). Sigurd is a fellow of the American Physical Society, a fellow of the Institute of Electrical and Electronics Engineers, a corresponding member of the Austrian Academy of Sciences, and an Alexander von Humboldt Foundation Senior Fellow. From Princeton, he received a 2014 Graduate Mentoring Award.