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Anisotropic Phase Transformation of Poly (Vinylidene Difluoride) for Energy Harvesting

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Poly (vinylidene difluoride) (PVDF) has been widely studied for energy harvesting of MEMS devices, particularly hybrid systems. As a semicrystalline polymer, the PVDF has five crystallographic forms, α, β, γ, δ and ε, only the latter four crystalline structures possess permanent dipole moment. We investigate effects of microstructures of the PVDF on its piezoelectricity for energy harvesting. Using combined experimental techniques of an atomic force microscope and a Fourier Transform Infrared Spectroscope, observation of surface morphology and phase transformation in time was made possible. Experiments on a linear stage indicated that an applied stress induced an output that is correlated with the phase transformation between amorphous, α, β, and γ phases. Specifically, the amorphous was transformed into the β phase. The transformation was time and direction dependent. Such transformation influences the energy harvesting of small devices.

Dr. Hong Liang is Professor of the Mechanical Engineering, Texas A&M University (TAMU). She obtained her Ph.D. in Materials Science and Engineering from the Stevens Institute of Technology in 1992. After spending two years as a postdoc at the National Institute of Standards and Technology, she was a senior engineer in the photonic and microelectronic industry. In 1998, she became an assistant professor at the University of Alaska Fairbanks and was promoted to associate professor with tenure in 2003. In 2004, Dr. Liang joined the faculty at TAMU. Professor Liang has been actively involved in research in tribology, surface and interface sciences, and advanced materials for various sensing applications. She is the fellow of the American Society of Mechanical Engineers (ASME) and the Society of Tribologists and Lubrication Engineers (STLE). She is the faculty fellow of the College of Engineering at the Texas A&M University in 2010-2011 and was the recipient of the NSF CAREER award in 2002.

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