

Use of Flat Ribbon like Electrode Geometry to Pole PVDF Piezoelectrics in Solution Processing

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Abstract — We study how ribbons of fluids subjected to electric fields can serve applications in energy harvesting. In particular the emphasis is on how the geometry (i.e. 2-D ribbons) can influence functionality. For applications related to energy harvesting we consider the use of polymer piezo electric Polyvinylidene fluoride (PVDF). There are other many conventional technologies for poling PVDF when it is in a solid state. Corona poling, photo-induced, photo-thermal and electron beam poling are the different techniques used for PVDF poling. The parallel plate capacitor structure made for poling the PVDF material while the PVDF is being cured. One key advantage of preparing PVDF is the ability of solution processing. Normally, the liquid is then spin coated on a substrate and left to dry. Either during the process of spin coating, or after drying - the film of PVDF is poled so as to align the dipoles and make a piezoelectric. We propose the use of a metal-insulator ribbon like electrode geometry to combine the process of fabrication and poling thereby making the process more efficient. On the application of a voltage across the electrodes, the voltage of V_s is developed across the fluid. These results in a field of V_s/d across the PVDF fill aiding the process of poling while the film is in liquid phase. Therefore the ribbon like geometry aids the use of PVDF piezoelectrics in two ways. Firstly, it makes the fabrication process efficient by combining the poling with the structure development. Secondly, the control of width (w) and length (l) aids the setup of the PVDF piezoelectric resonant frequency for a given thickness (d). This helps match the resonant frequency of the ribbon with the incoming low frequency vibration to improve the energy harvesting levels. Piezoelectrics can be used in submerged applications, large area PVDF energy scavengers, mechanical filters and sensors, rural electrification, and charging circuits for hand-held devices.