Supplementary Information (SI) for Journal of Materials Chemistry C.

Supplementary materials

Electrostriction contribution to the electromechanical response of cast chitosan films

Dayana Guzmán [1*], Qiancheng Zhang [2], Srikanth Kolagatla [2], Paula M. Vilarinho [1], Cláudia Nunes [1], Brian J. Rodriguez [2], Paula Ferreira [1]

[1] Department of Materials and Ceramic Engineering, CICECO – Aveiro Institute of Materials, University of Aveiro, Portugal

dlguzmans@ua.pt, paula.vilarinho@ua.pt, claudianunes@ua.pt, pcferreira@ua.pt

[2] School of Physics and Conway Institute of Biomolecular and Biomedical Research, University College Dublin, Dublin, Ireland

qiancheng.zhang@ucd.ie, srikanth.kolagatla@ucd.ie, brian.rodriguez@ucd.ie

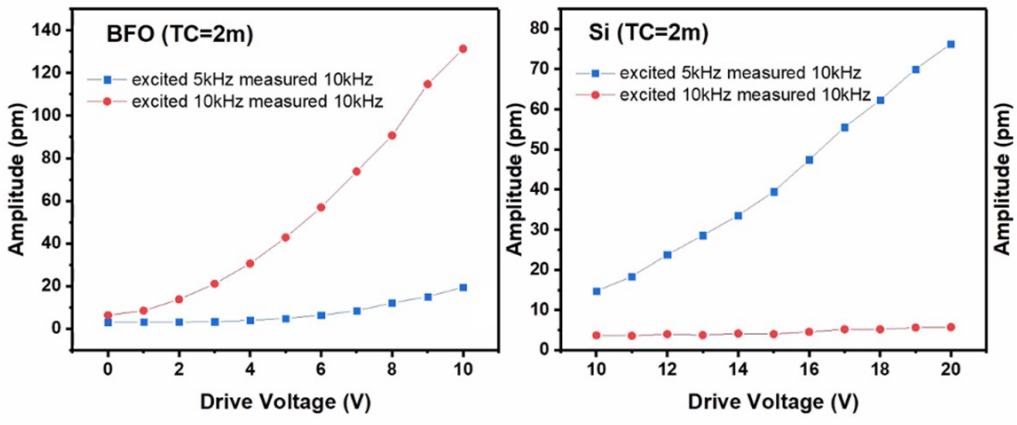

Figure S1. Comparison between the 1ω and 2ω *response of standard BFO and Si samples showing that the* 1ω *signal is greater than the* 2ω *signal for ferroelectric samples.*

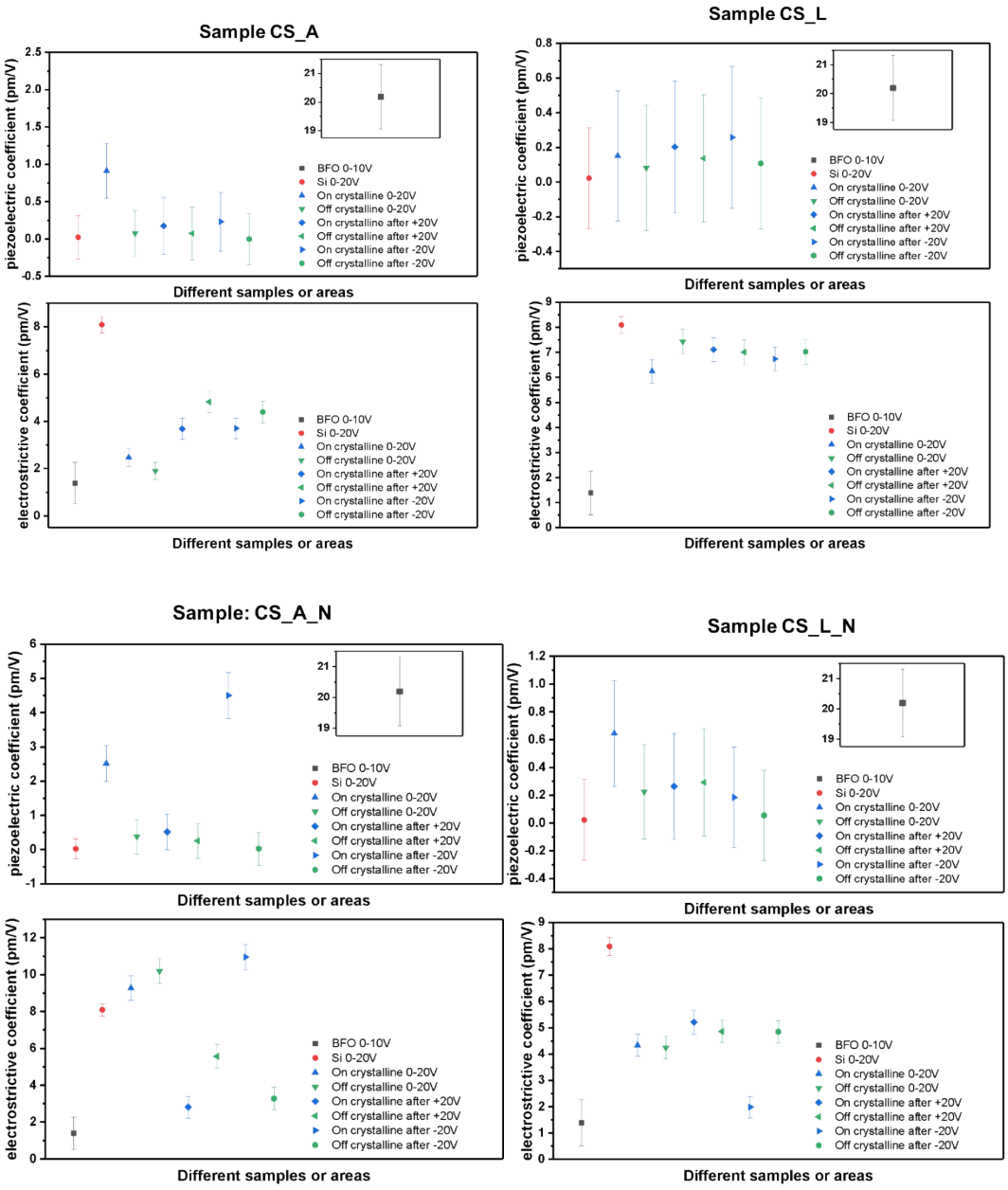

Figure S2. Comparison between the piezoelectric contributions of all the films on and off the crystalline regions compared with BFO and Si.

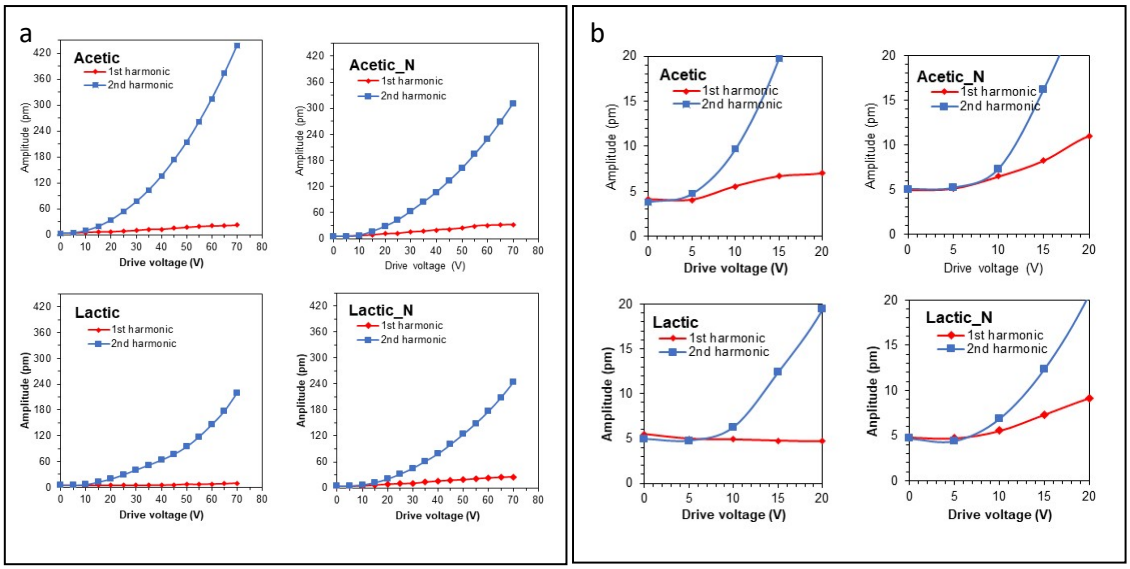

Figure S3. First harmonic, 1ω (red) and second harmonic, 2ω (blue) response of chitosan-based films to a VAC sweep for samples CS_A; CS_A_N; CS_L; and CS_L_N a) in one scale b) from 0-20 V. The piezoelectric component increases in neutralized samples, nevertheless the second harmonic signal is still significantly higher. The effect is also visible for lower values but not conclusive for 0-5V.

Table S1. Comparison of the piezoelectric and electrostrictive response of the chitosan films fabricated with acetic and lactic acid before and after neutralization treatment.

		Effective piezoelectric (pm/V)	*Electrostrictive component (pm/V)*	*Effective piezoelectric after +20V (pm/V)*	*Electrostrictive component after +20V (pm/V)*	*Effective piezoelectric after -20V (pm/V)*	*Electrostrictive component after -20V (pm/V)*
Crystalline	*CS_A_N/CS_A*	*2.76*	*3.75*	*3.00*	*0.76*	*19.57*	*2.96*
	CS_L_N/CS_L	*4.27*	*0.70*	*1.30*	*0.73*	*0.69*	*0.29*
non-crystalline	*CS_A_N/CS_A*	*4.63*	*5.34*	*3.57*	*1.15*	*2.00*	*0.74*
	CS_L_N/CS_L	*2.75*	*0.57*	*2.07*	*0.69*	*0.45*	*0.69*

Table S2. Measurements in Berlincourt equipment. d_{33} PiezoMeter Systems.

Sample	A_G0	L_G0	A_G0_N	L_G0_N
thickness (um)	40	43	30	40
Range*	VLO	VLO	VLO	VLO
capacitance	50.5 pF	49.4 pF	50 pF	51.1 pF
Tan delta	0.0546	0.0216	0.025	0.0983
static force	11.1	11.1	11	11.1
*VLO: Very low Range				

		frequency (Hz)							
	Dynamic force (I	30	70	110	140	210	240	300	
CS_A	0.1	-0.05	-0.03	-0.02	-0.02	-0.03	-0.01	0.3	d33 pC/N
	0.2	-0.04	-0.05	-0.03	-0.02	-0.05	-0.03	0.1	
	0.3	-0.05	-0.04	-0.05	-0.03	-0.04	-0.04	0.07	
	0.4	-0.02	-0.04	-0.04	-0.03	-0.04	-0.04	0.06	
	0.5	-0.03	-0.05	-0.06	-0.03	-0.04	-0.05	0.1	
		frequency (Hz)							
	Dynamic force (I	30	70	110	140	210	240	300	
CS_L	0.1	-0.03	-0.04	-0.05	-0.03	-0.01	-0.04	-0.04	d33 pC/N
	0.2	-0.08	-0.07	-0.05	-0.05	-0.05	-0.03	-0.03	
	0.3	-0.11	-0.09	-0.07	-0.05	-0.05	-0.05	-0.06	
	0.4	-0.09	-0.09	-0.07	-0.06	-0.06	-0.04	-0.05	
	0.5	-0.1	-0.09	-0.08	-0.07	-0.06	-0.05	-0.07	
		frequency (Hz)							
	Dynamic force (I	30	70	110	140	210	240	300	
CS_A_N	0.1	-0.03	-0.05	-0.03	-0.02	-0.01	-0.04	-0.05	d33 pC/N
	0.2	-0.04	-0.05	-0.04	-0.05	-0.04	-0.04	-0.05	
	0.3	-0.06	-0.06	-0.02	-0.05	-0.04	-0.04	-0.03	
	0.4	-0.08	-0.05	-0.03	-0.07	-0.05	-0.04	-0.06	
	0.5	-0.08	-0.06	-0.06	-0.06	-0.05	-0.05	-0.05	
		frequency (Hz)							
	Dynamic force (I	30	70	110	140	210	240	300	
CS_L_N	0.1	-0.07	-0.04	-0.02	-0.03	-0.02	-0.02	-0.05	d33 pC/N
	0.2	-0.04	-0.04	-0.04	-0.04	-0.05	-0.04	0.06	
	0.3	-0.03	-0.04	-0.05	-0.04	-0.06	-0.05	-0.06	
	0.4	-0.03	-0.06	-0.05	-0.05	-0.07	-0.04	-0.07	
	0.5	-0.06	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05	