Supporting information

Tuning Phase Composition of Polymer Nanocomposites towards High Energy Density and High Discharge Efficiency by Non-Equilibrium Processing

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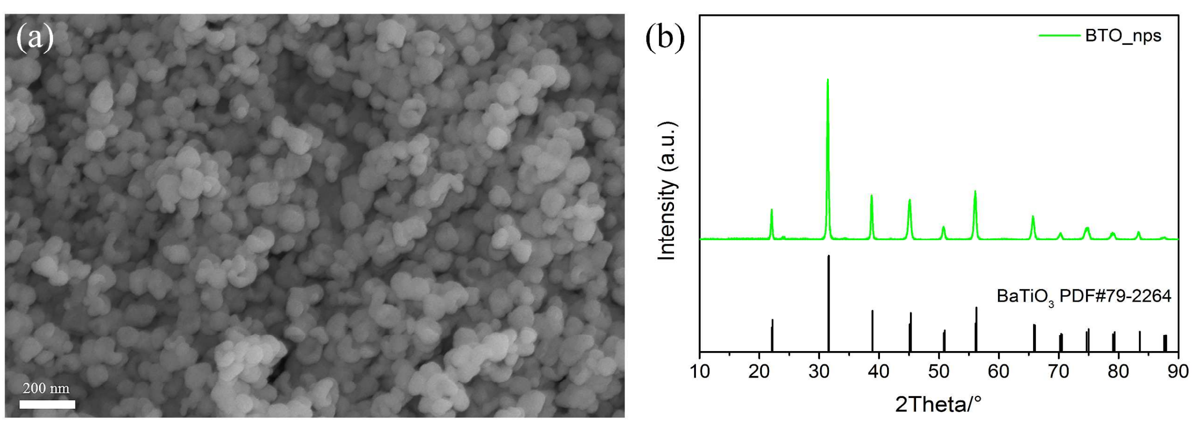


Figure S1. (a) The SEM image of BTO_nps. The size of BTO_nps is about 50 nm. (b) the corresponding XRD pattern of BTO_nsps.

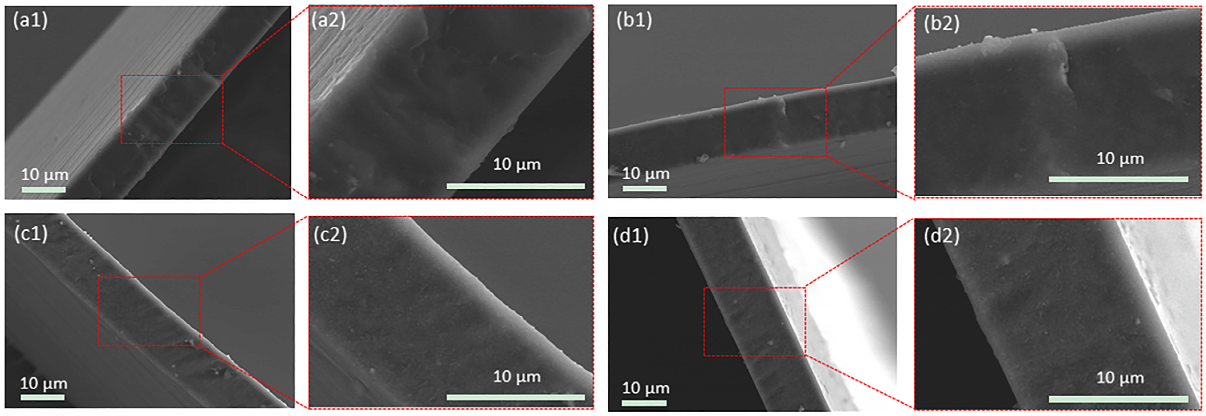


Figure S2. SEM images (a1, b1, c1, d1) and magnifying SEM images (a2, b2, c2, d2) of cross sections of BTO_nps/P(VDF-HFP) nanocomposite films by non-equilibrium process with different BTO_nps volume fractions: 0 vol.% (a), 1 vol.% (b), 5 vol.% (c), 10 vol.% (d).

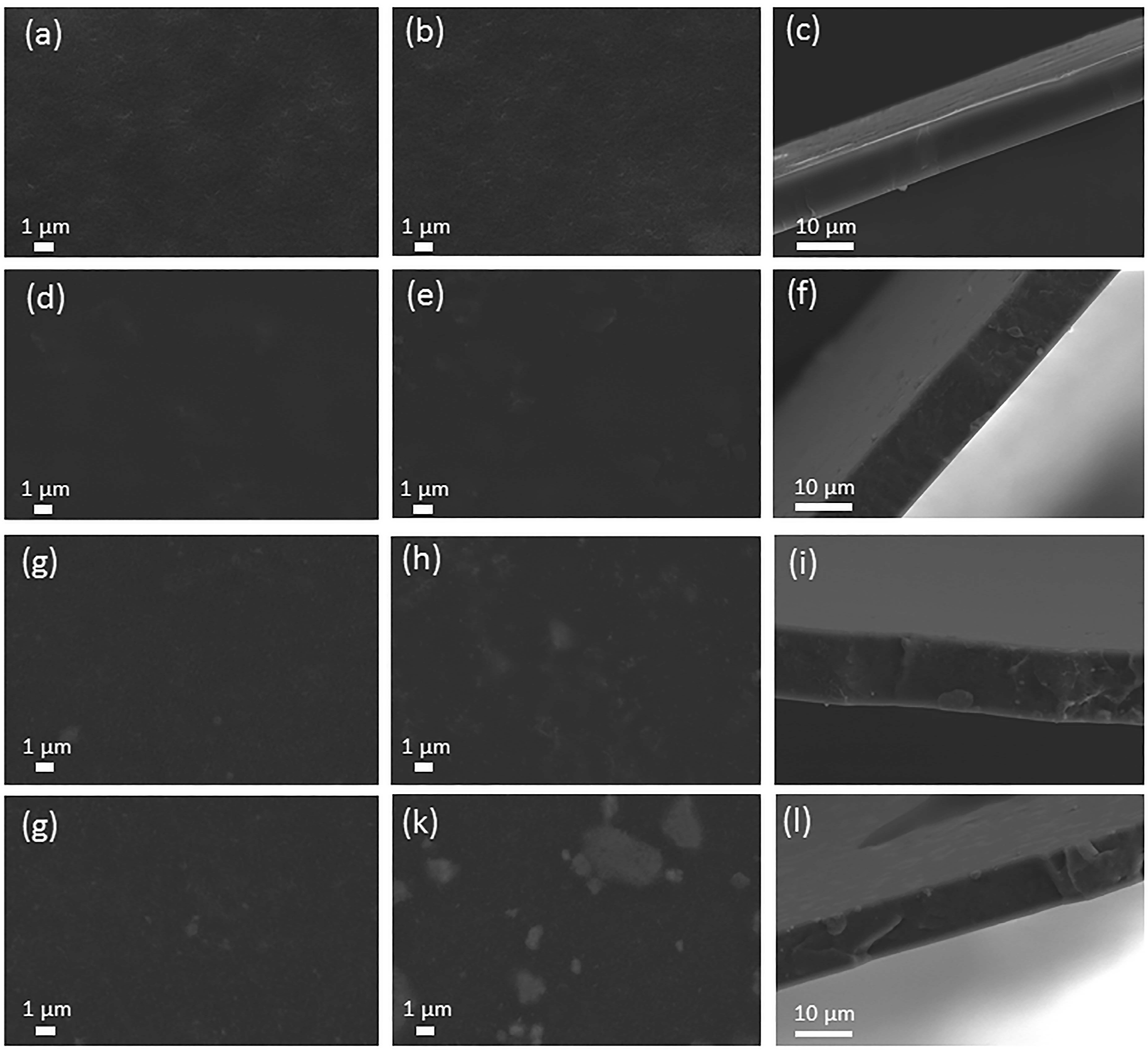


Figure S3. SEM images of top surfaces(a,d,g,j), bottom surfaces (b,e,h,k) and cross sections (c,f,i,l) of BTO_nps/P(VDF-HFP) nanocomposite films by equilibrium process with different BTO_nps volume fractions: 0

vol.% (a,b,c), 1 vol.% (d,e,f), 5 vol.% (g,h,i), 10 vol.% (j,k,l).

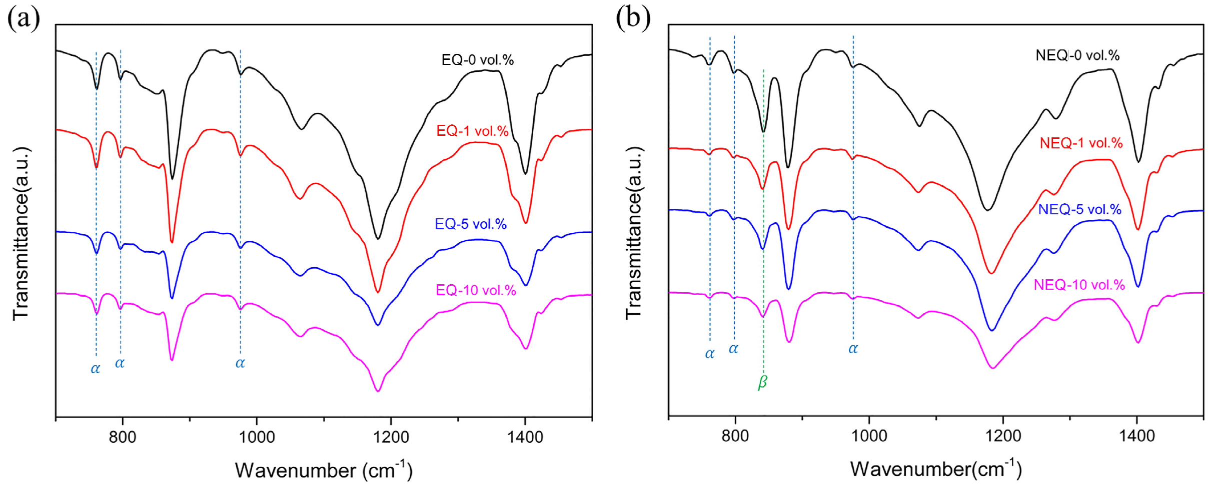


Figure S4. FTIR patterns of equilibrium (a) and non-equilibrium (b) nanocomposite films, respectively.

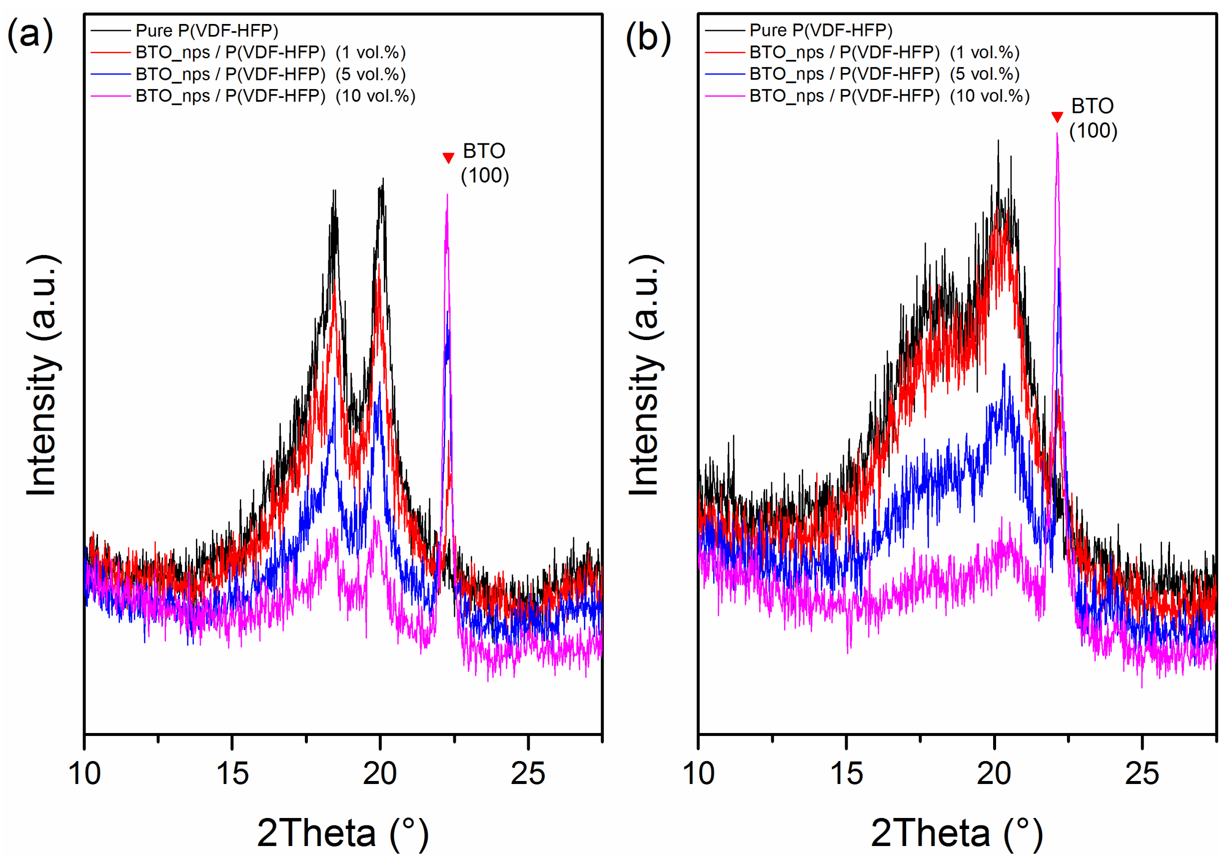
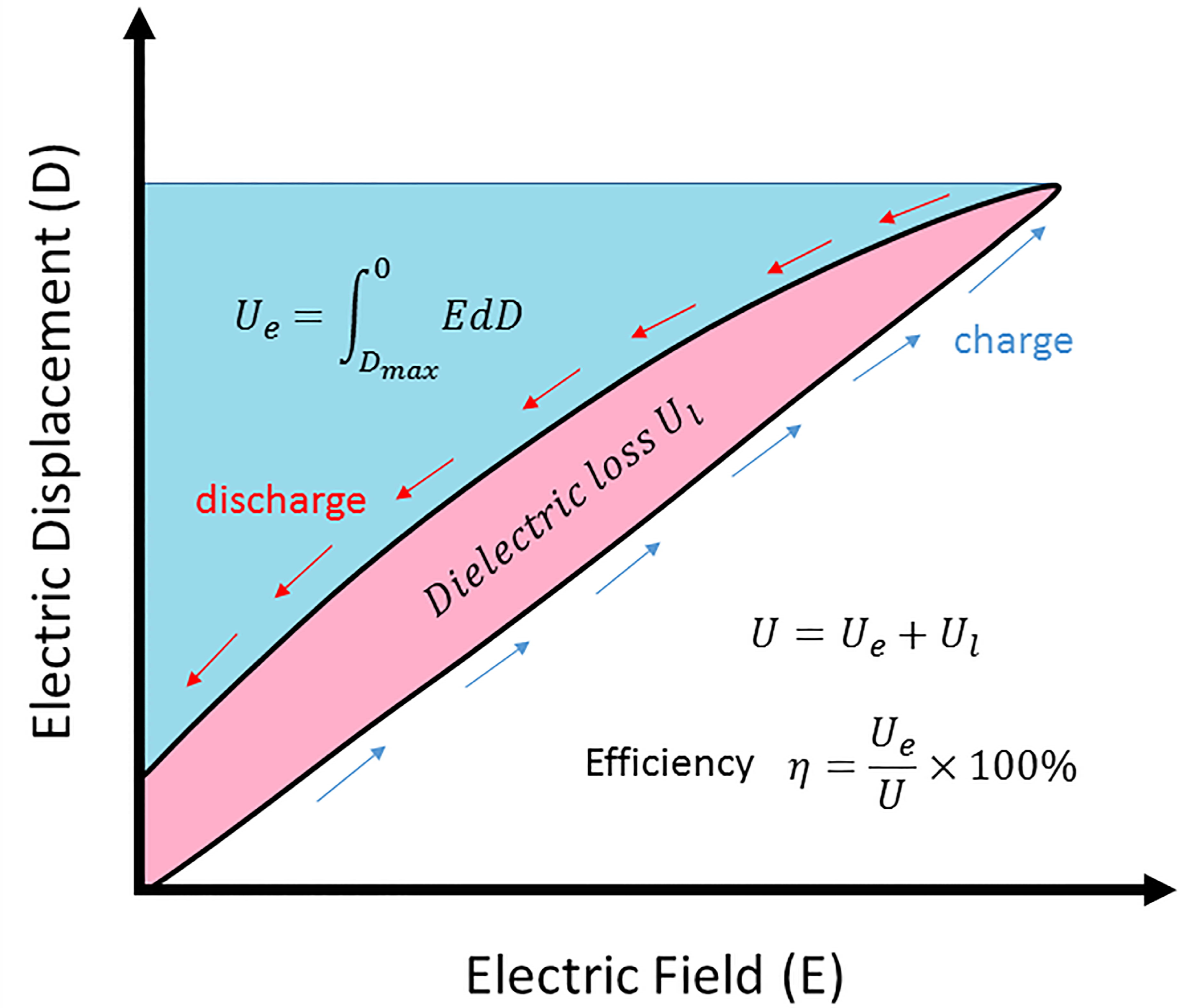


Figure S5. WAXD patterns of pure P(VDF-HFP) films and BTO_nps/P(VDF-HFP) nanocomposite films fabricated with equilibrium (a) and non-equilibrium (b) processes, respectively.



Figures S6. Schematic D-E loop for a dielectric material. The discharged energy density (U_e) is represented by the cyan area between the discharge curve and the electric displacement axis, while the energy dissipated (U_l) is indicated by the pink area surrounded by the loop curve. Apparently, the totally charged energy density (U) equals to U_e plus U_l. The charge-discharge efficiency is defined as $U_e/U\times100\%$.

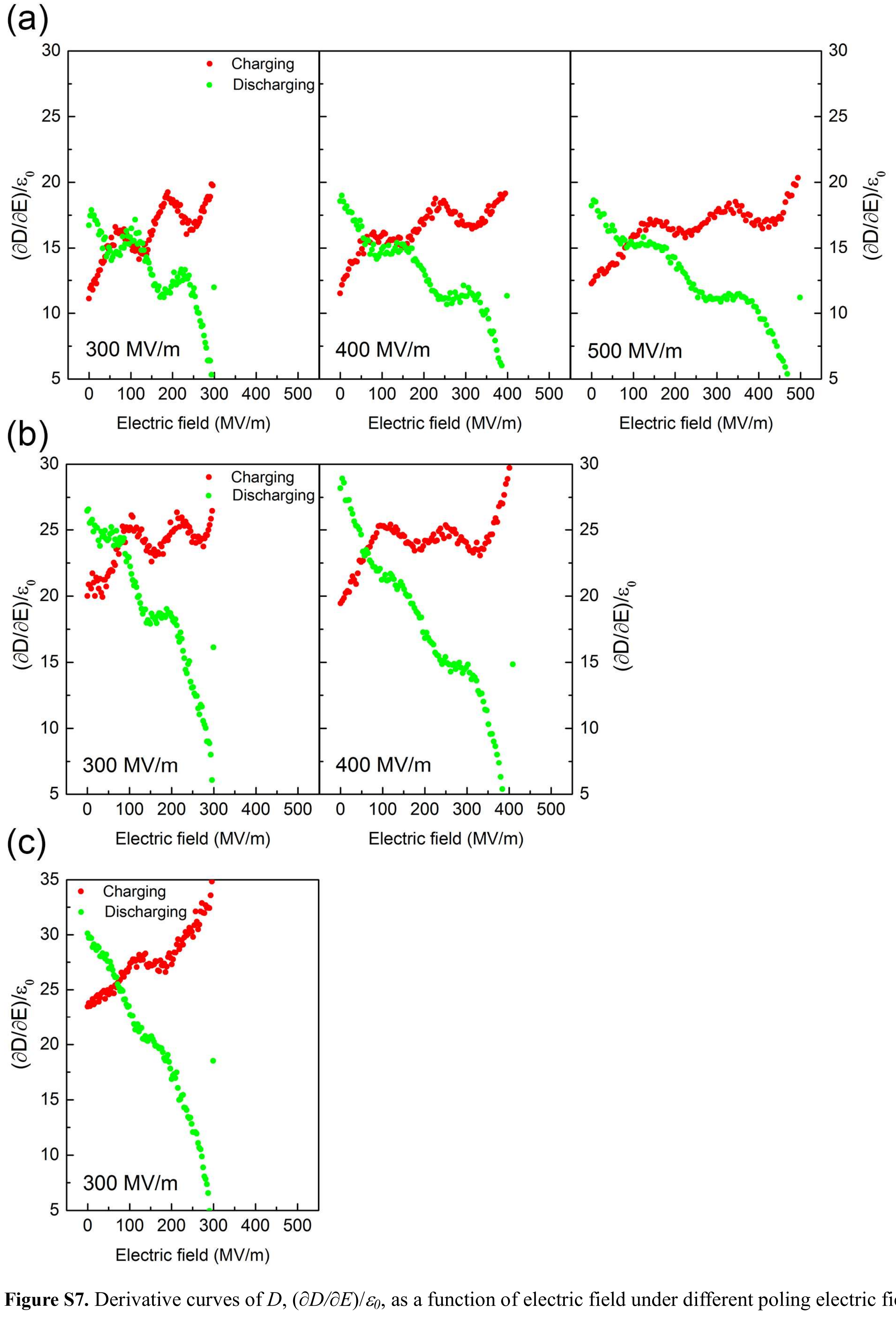


Figure S7. Derivative curves of D, $(\partial D/\partial E)/\varepsilon_0$, as a function of electric field under different poling electric field (300-500 MV/m) for equilibrium nanocomposite films with 1vol.% (a), 5 vol.% (b) and 10 vol.% (c) BTO_nps loading, respectively.

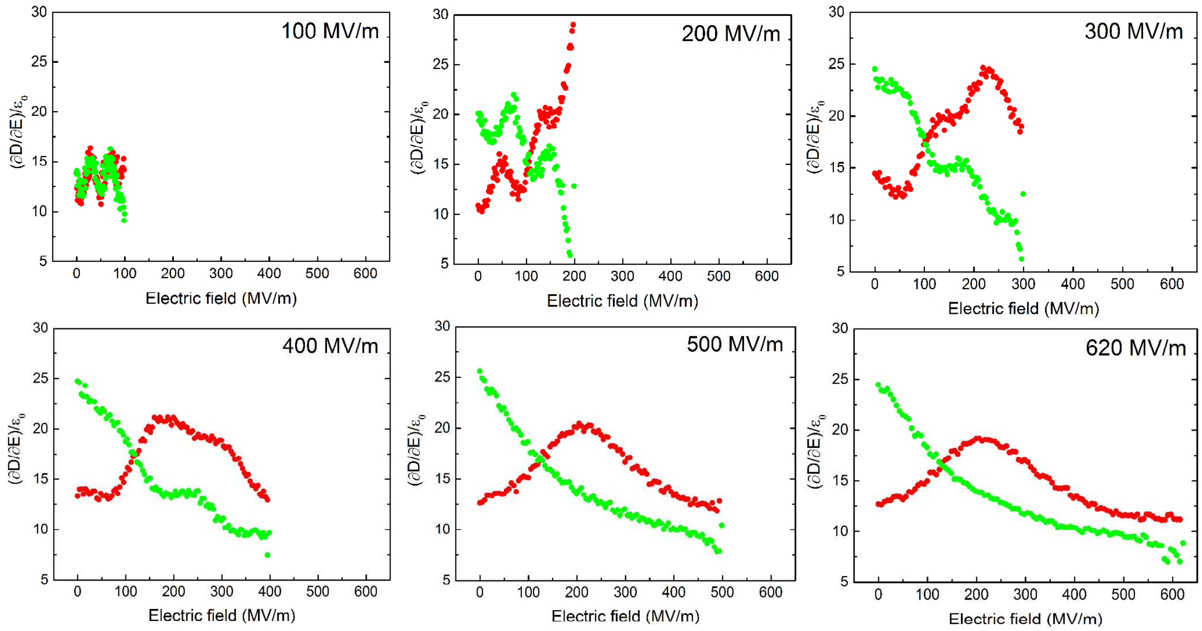


Figure S8. Derivative curves of D, $(\partial D/\partial E)/\varepsilon_0$, as a function of electric field under different poling electric field for pure non-equilibrium P(VDF-HFP) films.

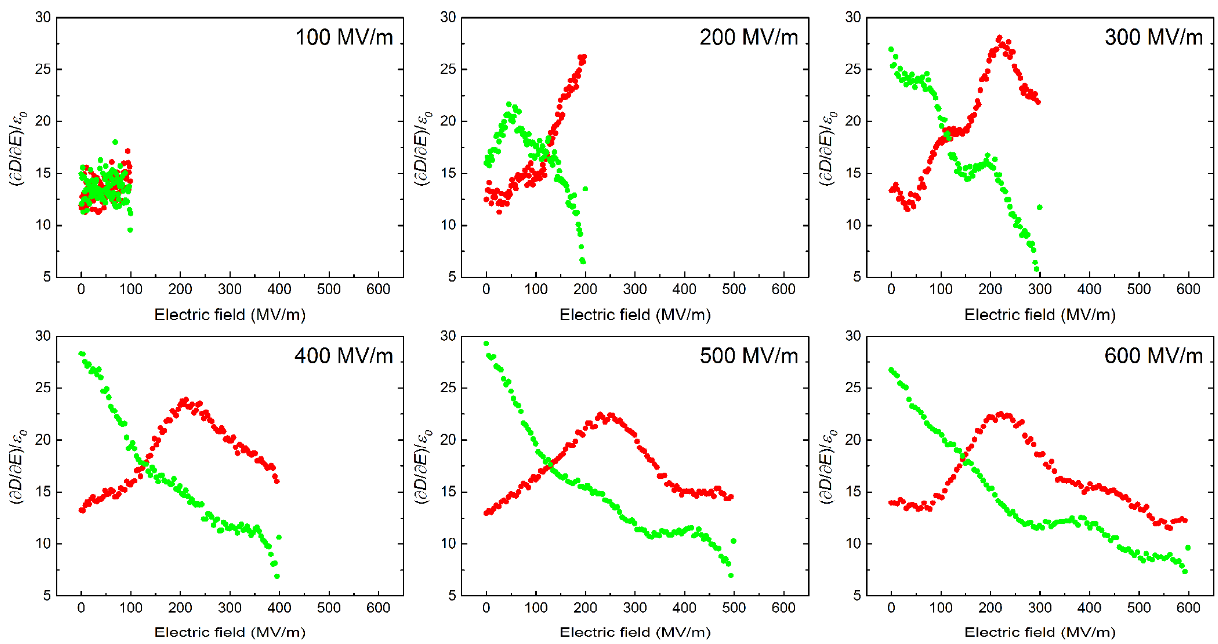


Figure S9. Derivative curves of D, $(\partial D/\partial E)/\varepsilon_0$, as a function of electric field under different poling electric field for non-equilibrium nanocomposite films with 1vol.% BTO_nps loading.

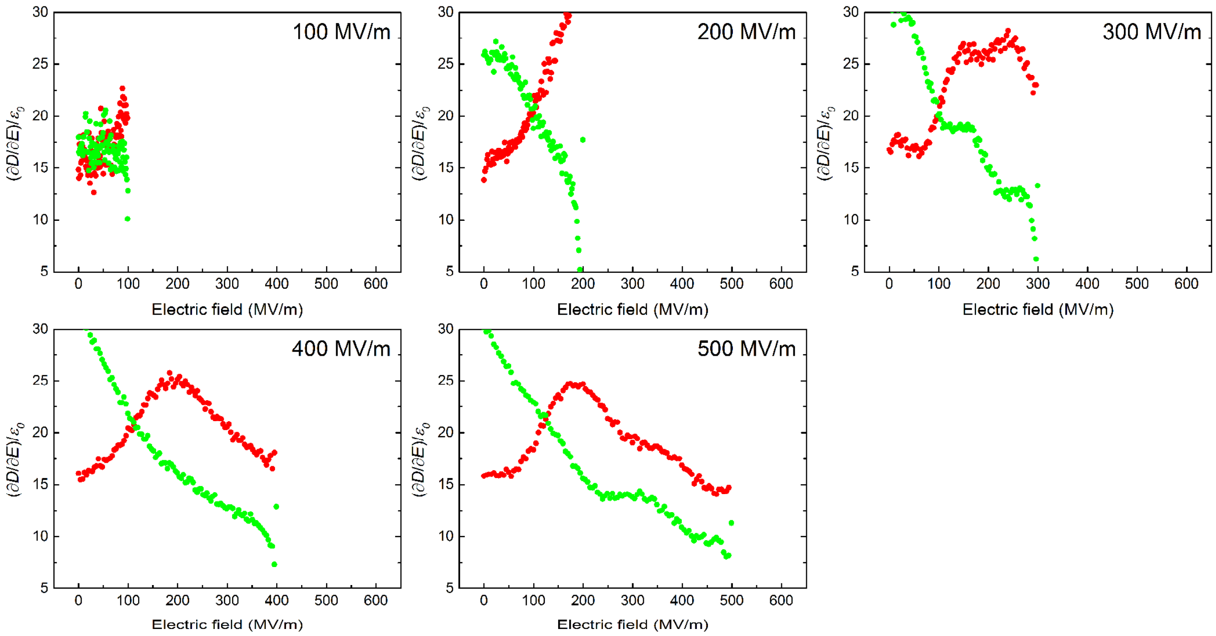


Figure S10. Derivative curves of D, $(\partial D/\partial E)/\varepsilon_0$, as a function of electric field under different poling electric field for non-equilibrium nanocomposite films with 5vol.% BTO_nps loading.

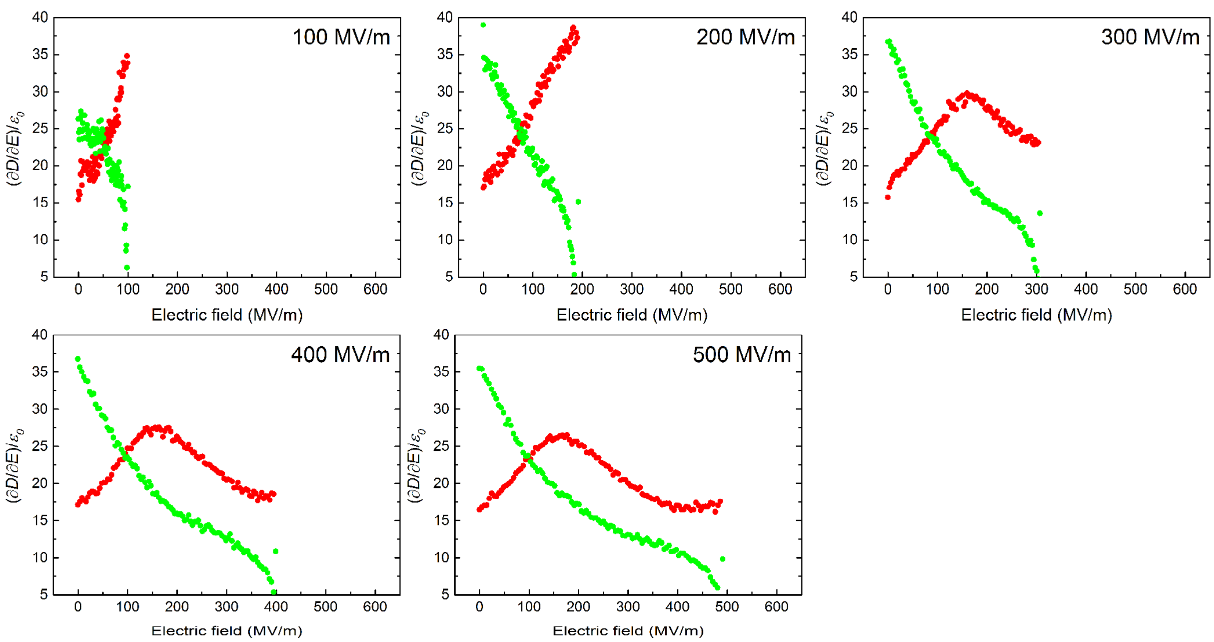


Figure S11. Derivative curves of D, $(\partial D/\partial E)/\varepsilon_0$, as a function of electric field under different poling electric field for non-equilibrium nanocomposite films with 10vol.% BTO_nps loading.

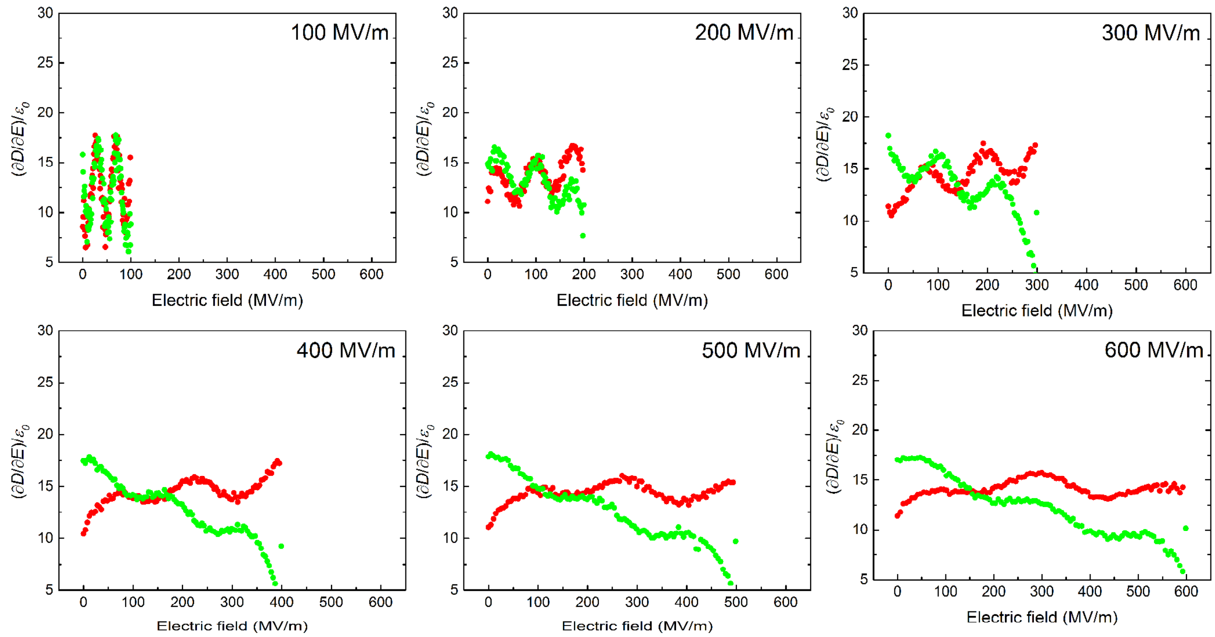


Figure S12. Derivative curves of D, $(\partial D/\partial E)/\varepsilon_0$, as a function of electric field under different poling electric field for pure equilibrium P(VDF-HFP) films.

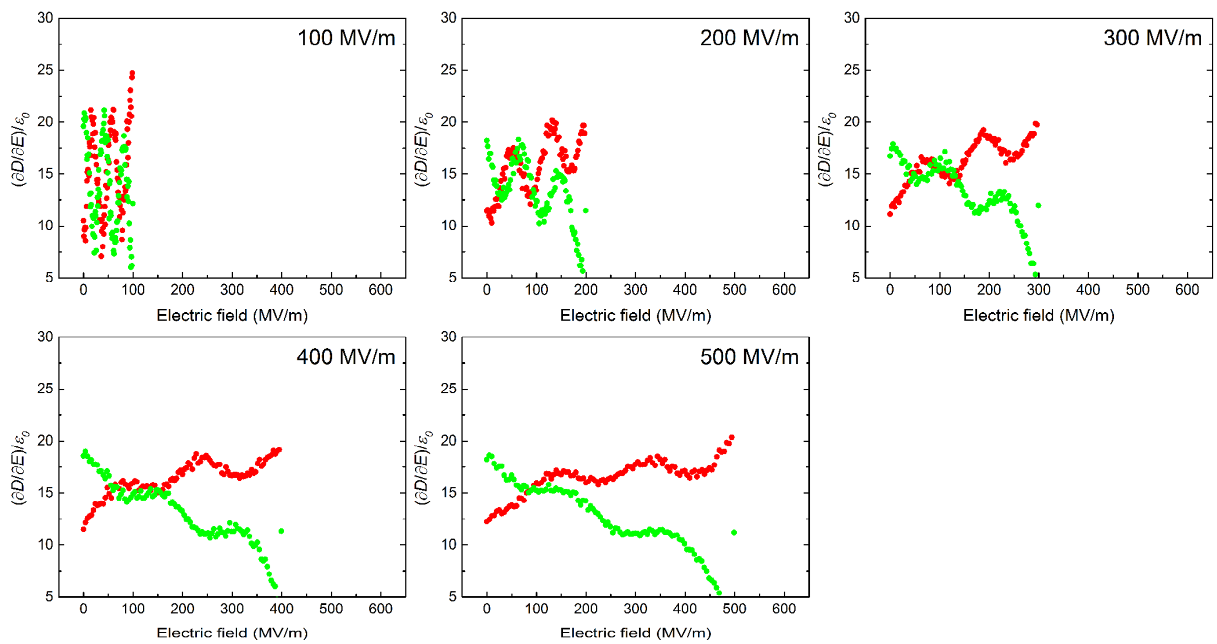


Figure S13. Derivative curves of D, $(\partial D/\partial E)/\varepsilon_0$, as a function of electric field under different poling electric field for equilibrium nanocomposite films with 1vol.% BTO_nps loading.

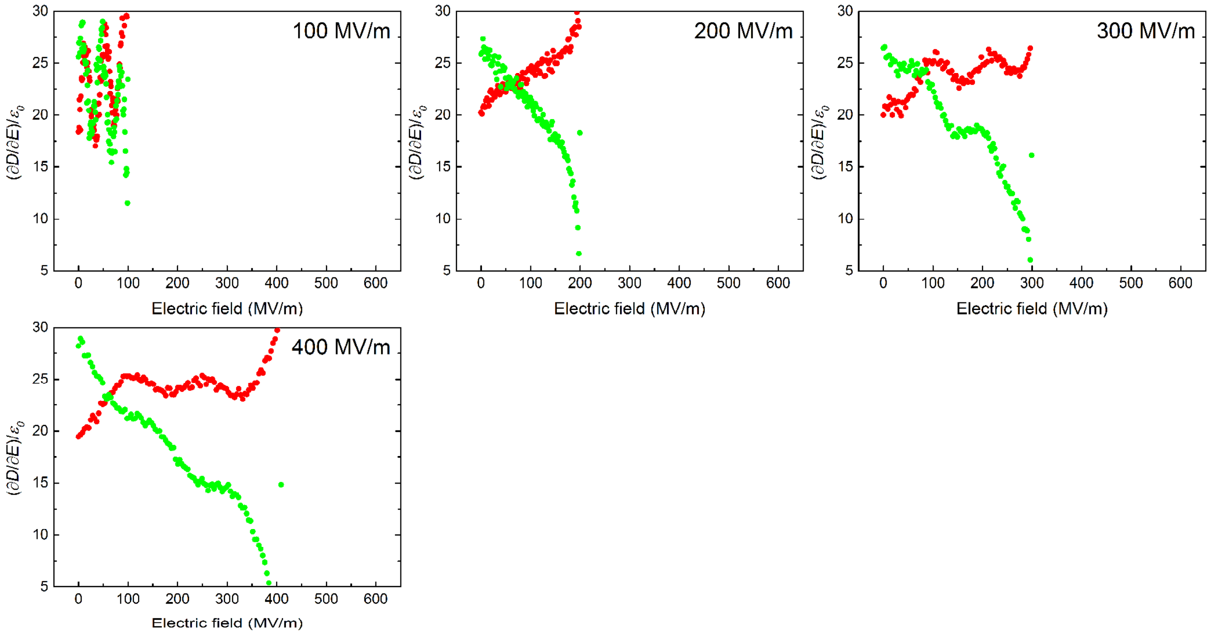


Figure S14. Derivative curves of D, $(\partial D/\partial E)/\varepsilon_0$, as a function of electric field under different poling electric field for equilibrium nanocomposite films with 5vol.% BTO_nps loading.

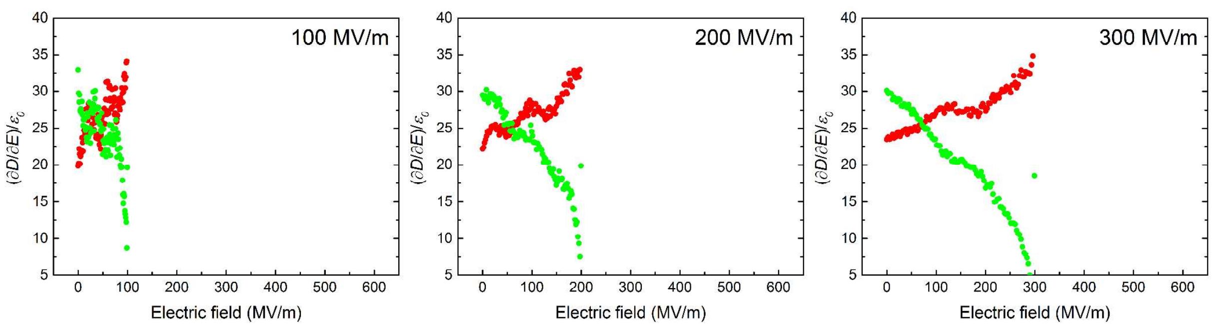


Figure S15. Derivative curves of D, $(\partial D/\partial E)/\varepsilon_0$, as a function of electric field under different poling electric field for equilibrium nanocomposite films with 10vol.% BTO_nps loading.