Supporting Information

Simultaneously enhanced discharge energy density and efficiency in nanocomposite films capacitors utilizing two-dimensional $NaNbO_3$@Al_2O_3 platelets

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Supporting Information 1

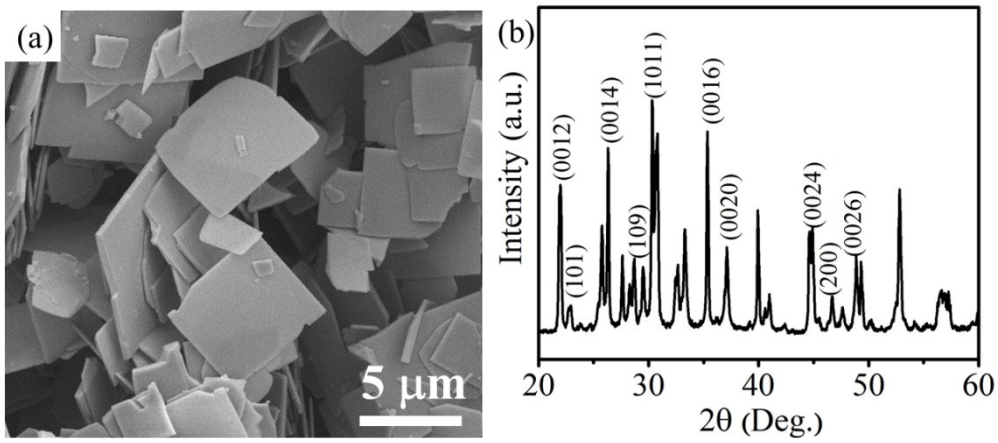

Figure S1 SEM images and XRD of 2D $Bi_{2.5}Na_{3.5}Nb_5O_{18}$ platelets

Supporting Information 2

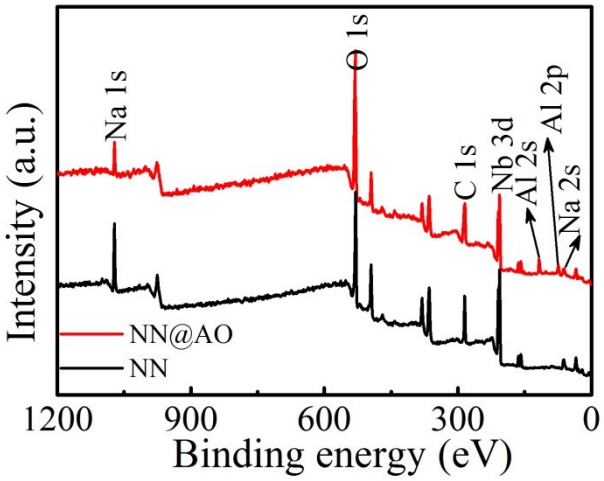

Figure S2 XPS images of 2D NN and 2D NN@AO Ps.

Supporting Information 3

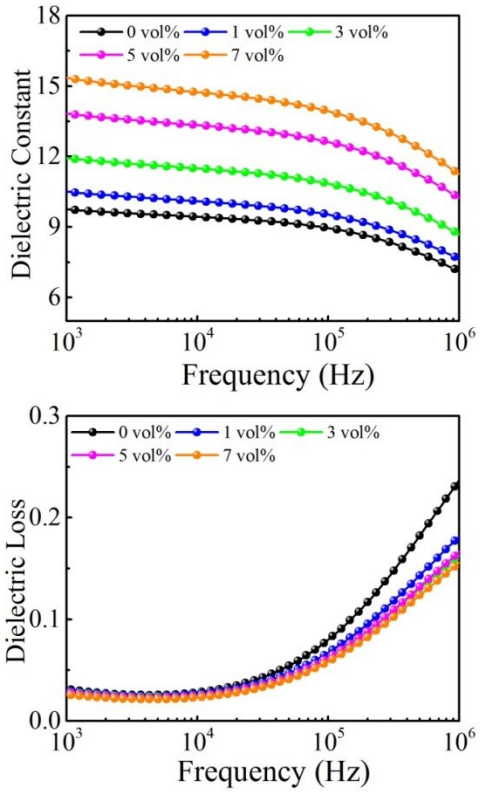

Figure S3 The variations of (a) dielectric constants (εr) and dielectric loss (tanδ) with the frequency for pure polymeric matrix and composite films with different contents of 2D NN Ps.

The dielectric constants and dielectric loss of the nanocomposite films with 2D NN Ps and NN@AO Ps exhibits the same change trend. The dielectric constant of the nanocomposite films decrease with increasing frequency, since the dipole mobility of the polymer matrix is limited at high frequencies. With increasing of the fillers, the dielectric constants of the nanocomposites films all increase monotonously to compare with pristine PVDF-HPF, which the reason as follows. i) Higher permittivity of the fillers leading to the most of charges accumulation at the interfaces of between the fillers and matrices. ii) The 2D NN Ps and NN@AO Ps have a large aspect ratio. In addition, At the low frequency (10^2 to 10^3 Hz), the dielectric loss decreases slightly, owing to the Maxwell−Wagner−Sillar (MWS) interfacial polarization. Moreover, the dielectric loss significantly enhances from 10^4 to 10^6 Hz. This phenomenon is typical of the glass transition relaxation of pure PVDF-HPF.

Supporting Information 4

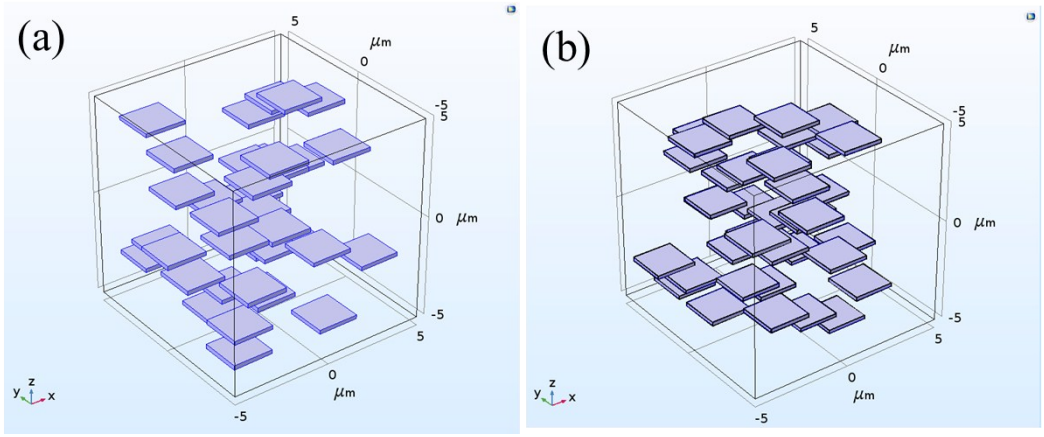

Figure S4 Three-dimensional models of the simulation system for 3 vol.% NN NSs/P(VDF-HFP) and 3 vol.% NN@AO NSs/P(VDF-HFP) composite films.

Supporting Information 5

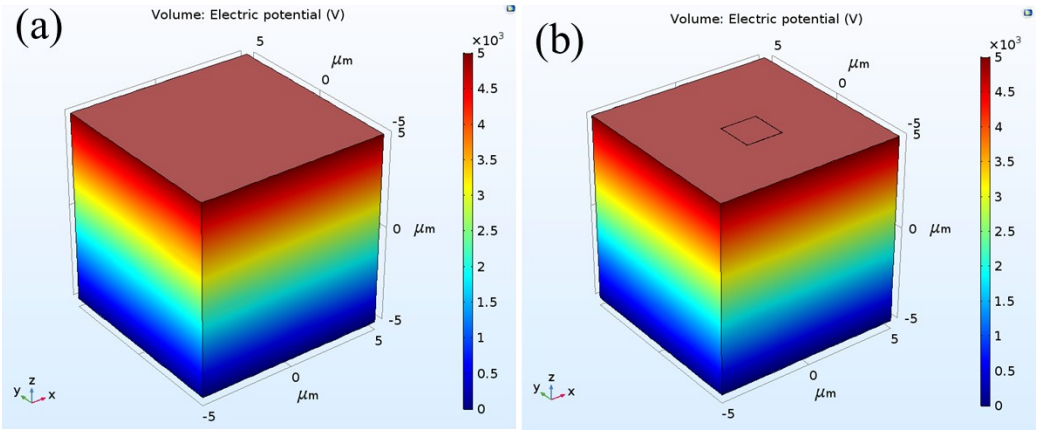

Figure S5 Three-dimensional models mages of the electric potential for 3 vol.% NN NSs/P(VDF-HFP) and 3 vol.% NN@AO NSs/P(VDF-HFP) composite films.

Supporting Information 6

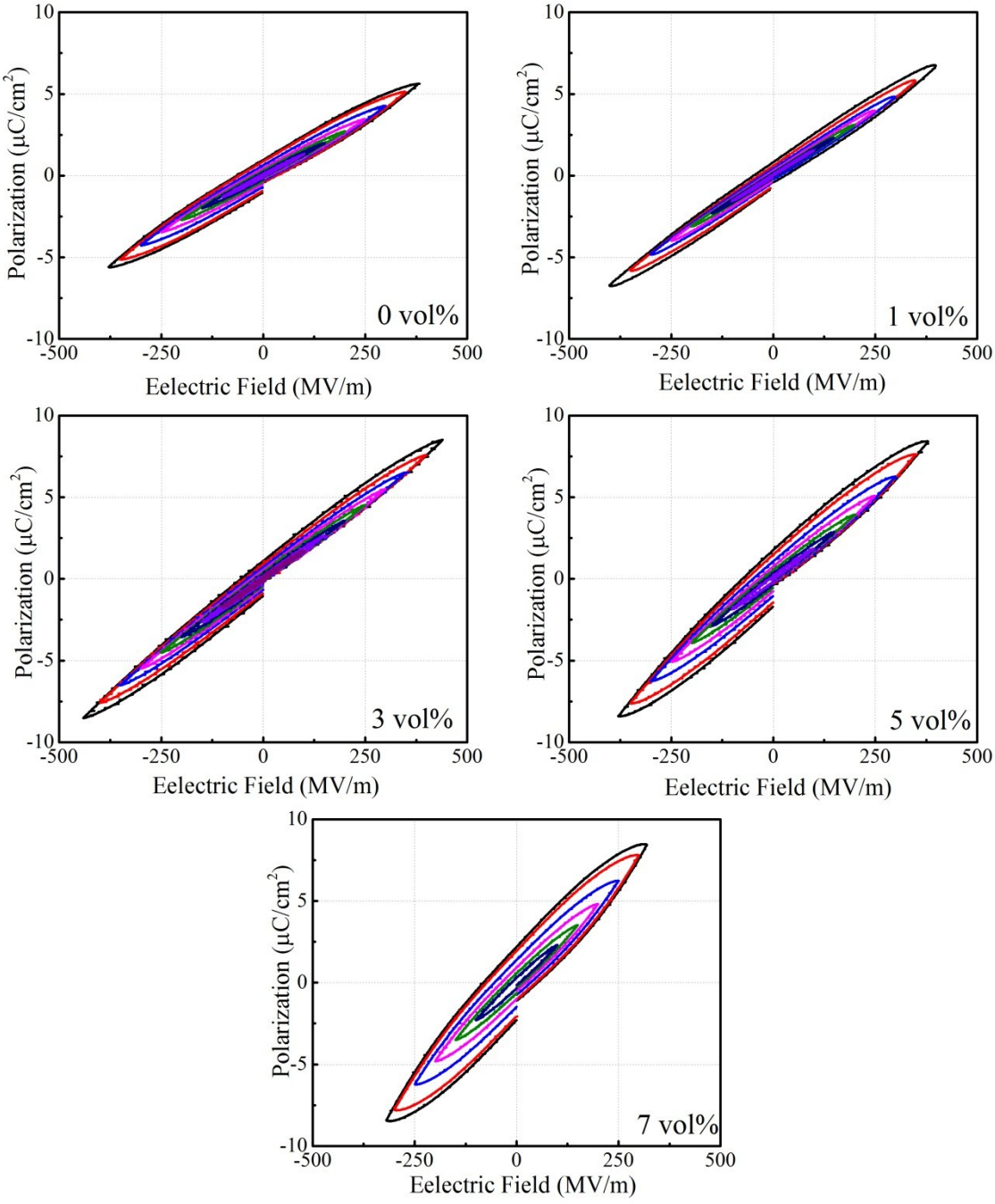

Figure S6 D-E curves of pure P(VDF-HFP) and NN@AO NSs/P(VDF-HFP) composite films with different contents fillers**.**

Supporting Information 7

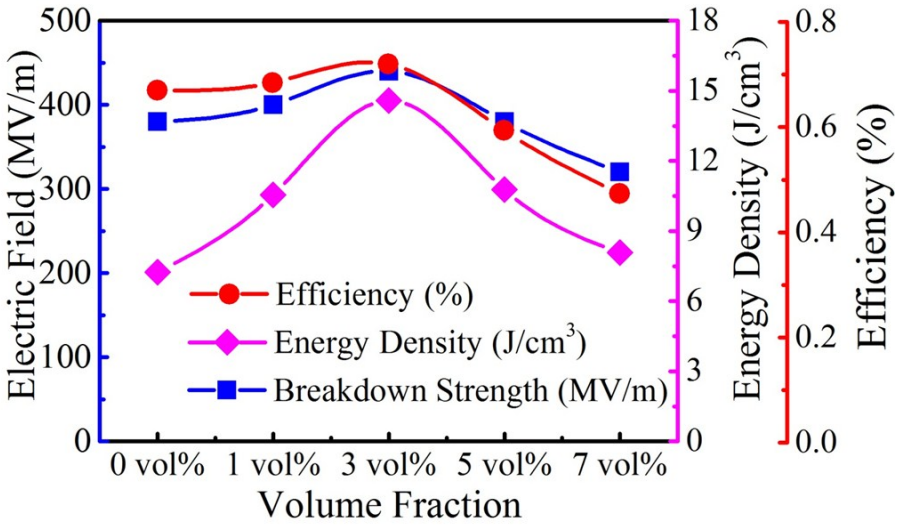

Figure S7 Breakdown strength, energy density, and efficiency of pure P(VDF-HFP) and NN@AO NSs/P(VDF-HFP) composite films.

Supporting Information 8

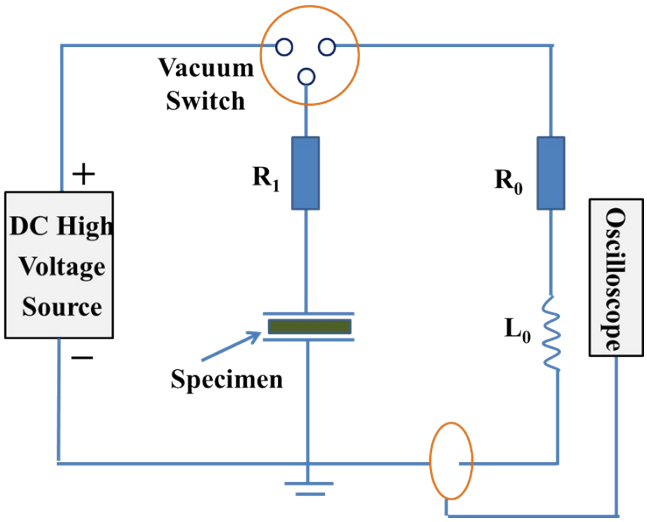

Figure S8 Fast charge-discharge experimental platform.