Designing energy and memory storage materials using cellulose modified graphene oxide nanocomposites

S1-Characterizing synthesized graphene oxide (GO) by AFM and TEM–

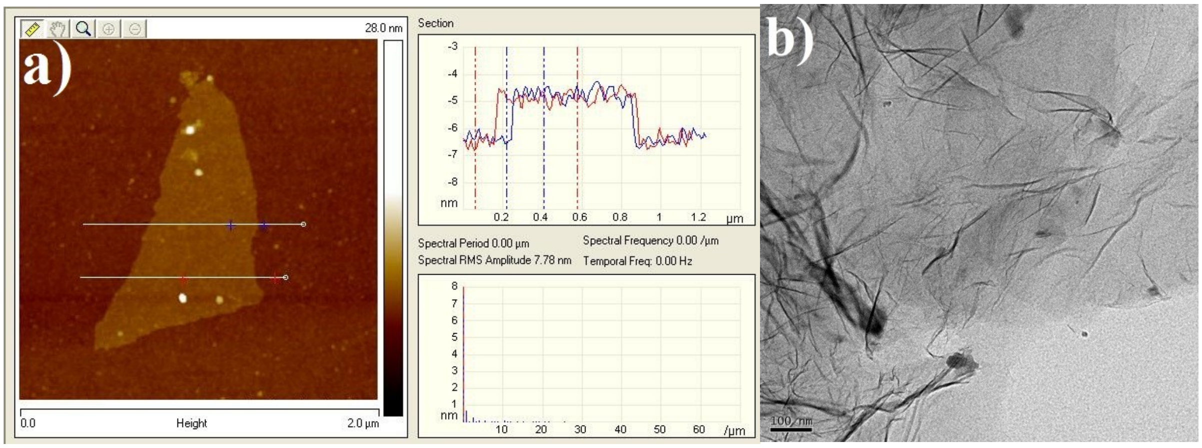

Figure S1: a) Two dimensional AFM image of GO casted on silica wafer b) TEM image of GO

GO synthesized by improved graphene oxide synthesis method was the substrate to obtain modified graphene oxide. The morphology of GOs was checked with the help of an atomic force microscope (Veeco AFM) and a high resolution field emission transmission electron microscope (FE-TEM, JEOL, JEM 2100F). The AFM image of the GO sheets casted on silica wafer is given in Figure S1a, from which the thickness of the GO layer is measured to be ~1.5 nm. For TEM, drops of GO suspension in water (0.01%w/v), were deposited on carbon-coated electron microscope grids and the image as shown in Figure S1b was obtained. The bright-field smooth TEM image reveals the overlapping and barely distinguishable morphology of GOs from the slightly darker double sheet regions and its crystallinity.

S2-Optical transparency–

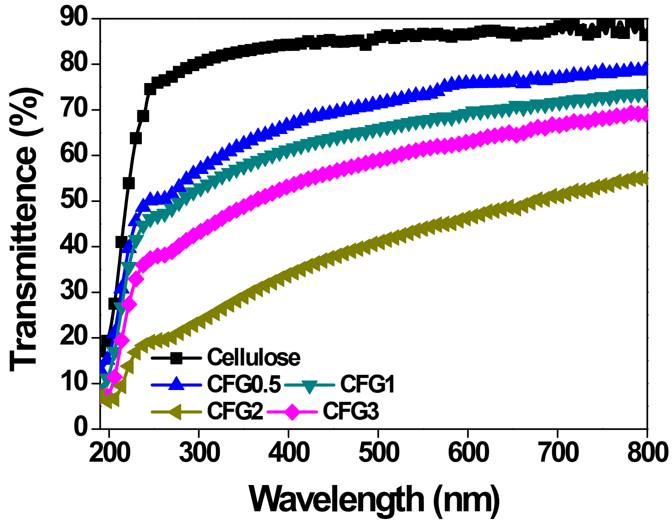

Figure S2: UV-Visible Transparency comparisons among cellulose and cellulose composites

Figure S2 illustrates the effect of GOs on the transmittance properties of cellulose. The given transmittance versus wavelength plots shows an increase in transmittance at 200-800 nm, which is approximately the lower limit of the visible region. The average transmittance values for all the samples, cellulose, CFG0.5, CFG1, CFG2 and CFG3 films in the UV- visible range are 88, 41, 22, 16 and 12% respectively (at 500 nm). GOs at 0.5wt% loading impart moderate transparency to the nanocomposites and among all other composite samples, CFG0.5 shows significantly higher optical transmittance. With increasing filler concentration, especially for CFG3, the optical transmittance was found to reduce, probably due to stacks of flackes. The highly dense large flake sized GOs (as evidenced from the AFM and TEM in Figure S1) make light scattering through the film difficult. This indicates the dependence of the optical properties of the cellulose-g-GO composites on the concentration of GO as well as the mode of dispersion.

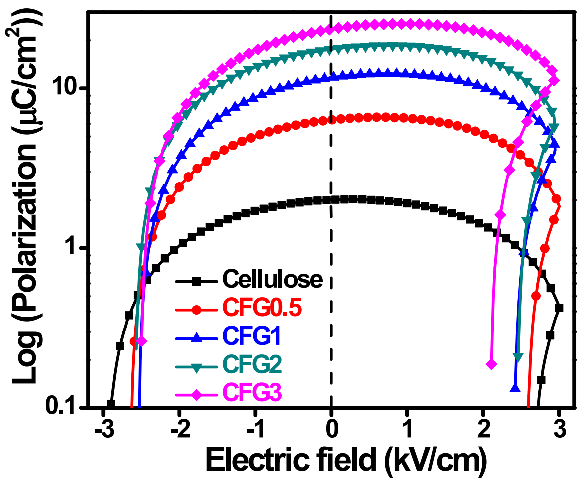

Figure S3: Variation of ferroelectric properties LogP-E of cellulose-g-GO composites and neat cellulose (R_H 25% and T= 25 °C)

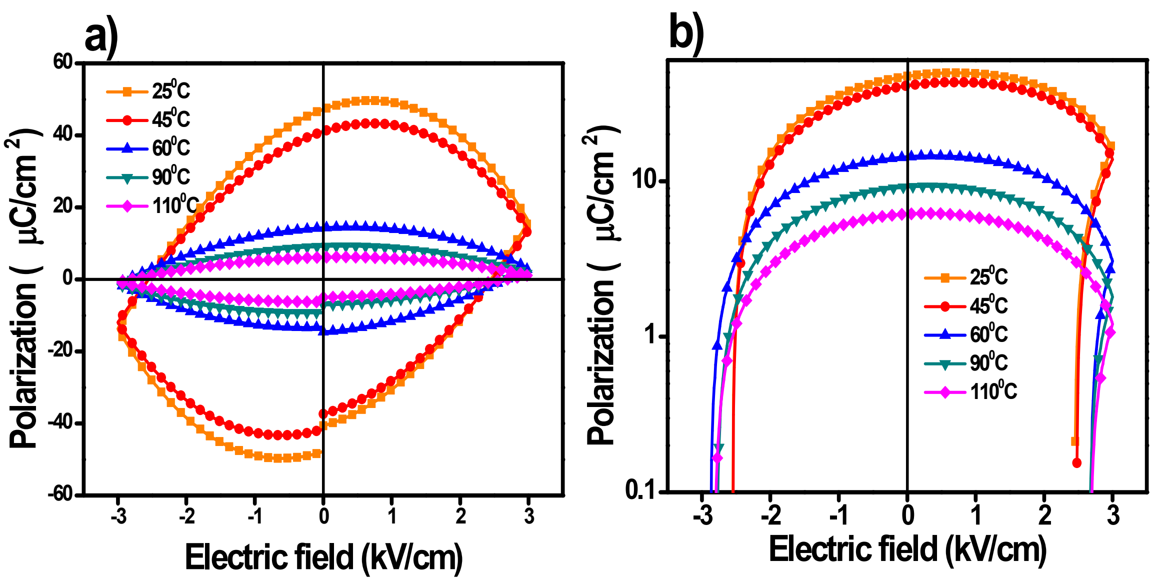

Figure S4: Temperature variation of ferroelectric properties a) P-E b) LogP-E of CFG3 composites (R_H 25%)

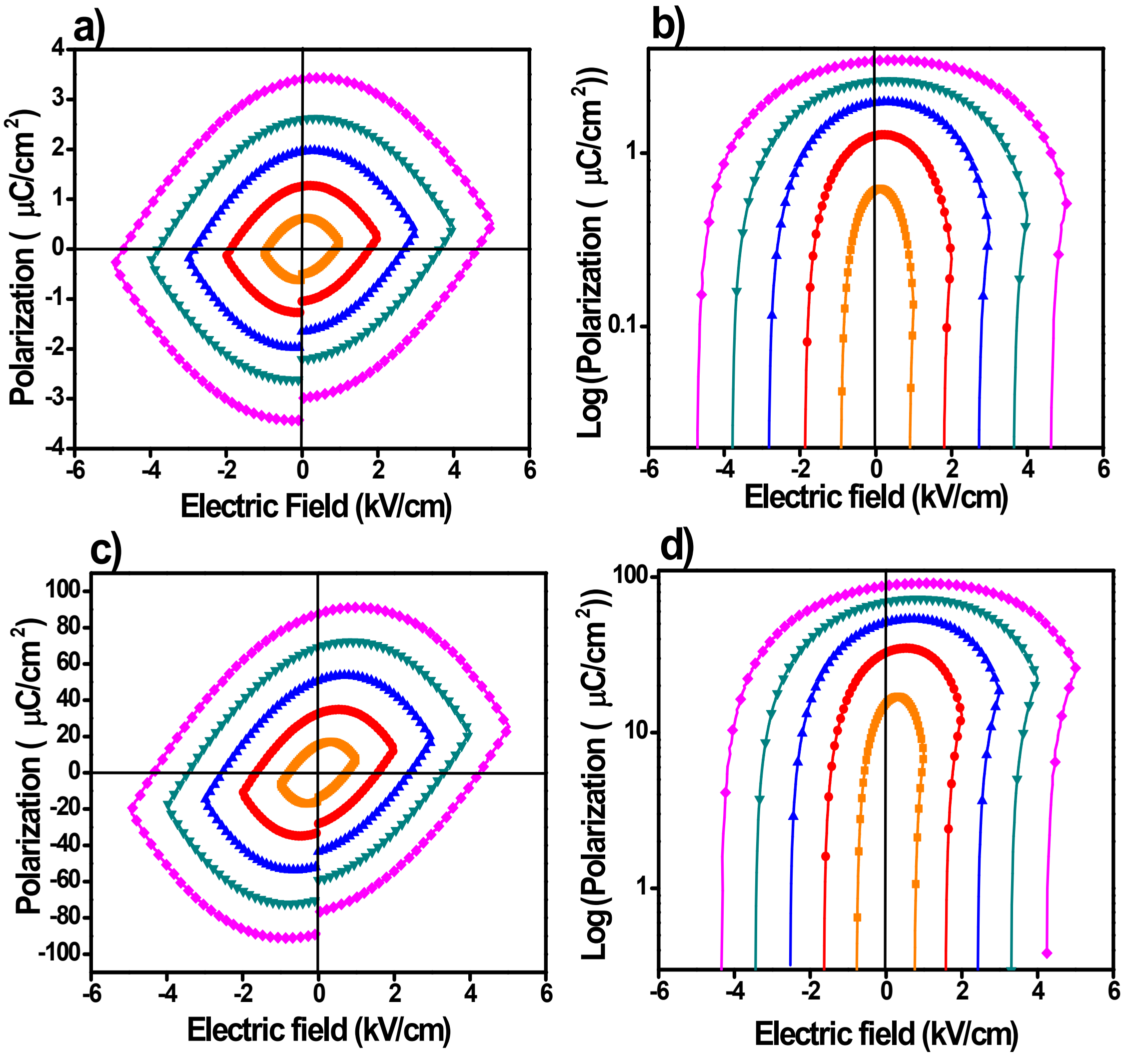

Figure S5: Electric field variation of ferroelectric properties of cellulose a) P-E b) LogP-E and for CFG c) P-E d) LogP-E (R_H 25% and T= 25 °C)