Electronic Supplementary Material (ESI) for Nanoscale

Supplementary figures

Nanoparticle Induced Piezoelectric, Super Toughened, Radiation Resistant, Multi-functional Nanohybrids

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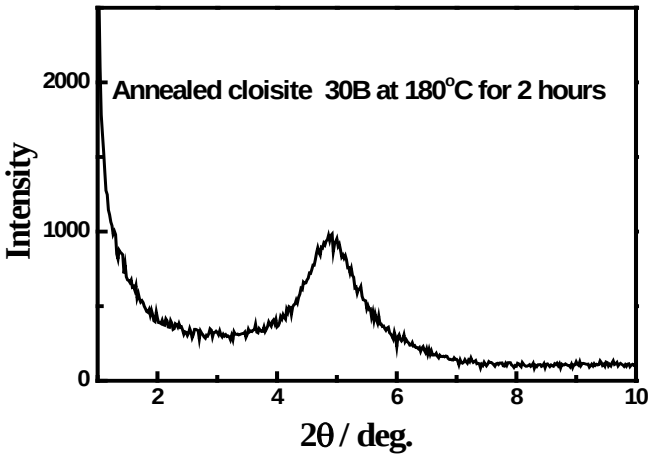

Figure S1: *XRD* patterns of annealed cloisite 30B at 180 ^{o}C for 2 hours showing the same peak position before annealing. So, there is no degradation of organic component up to 180 ^{o}C or processing temperature of the nanohybrids.

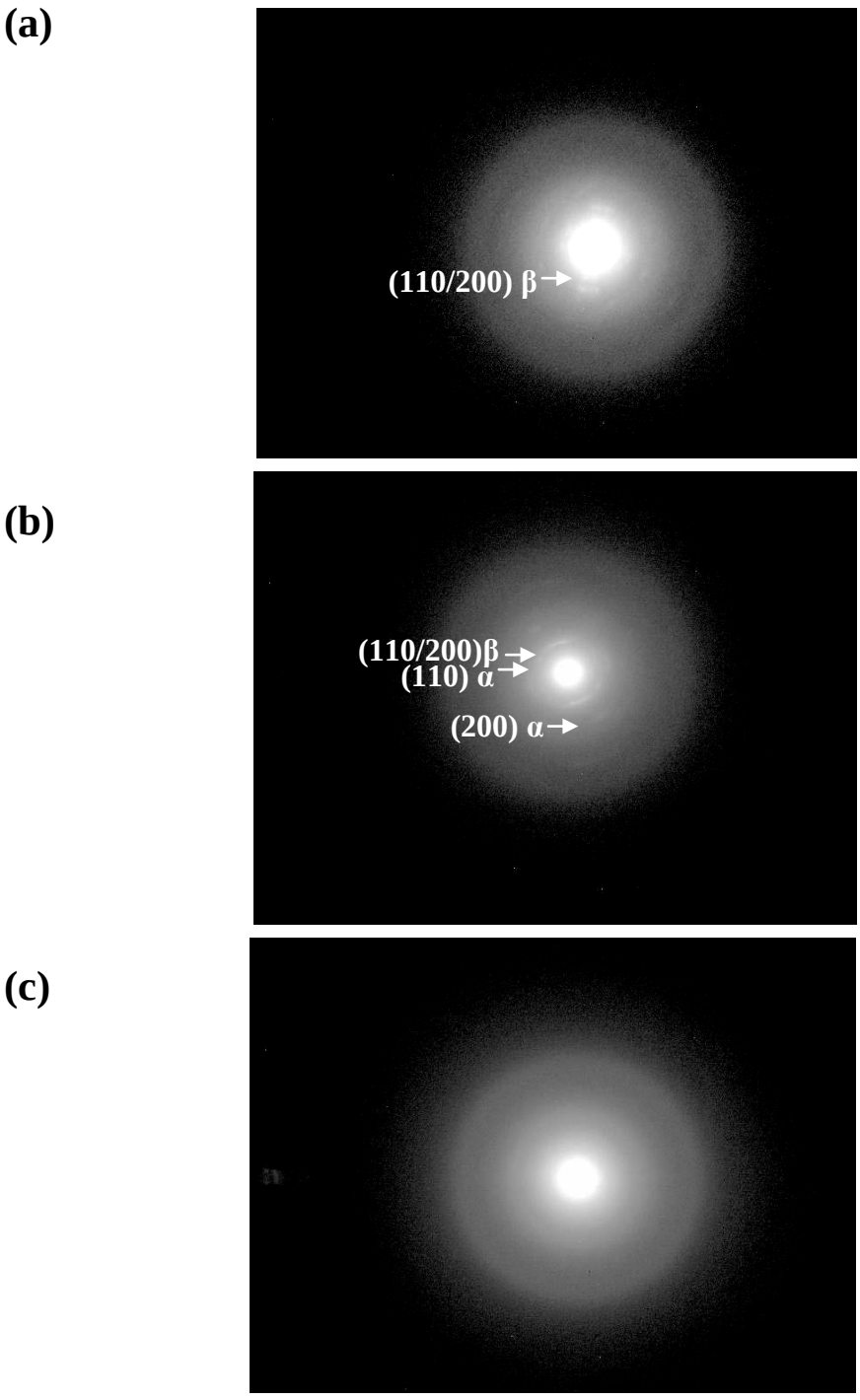

Figure S2: Electron diffraction patterns showing (a) β-phase, (vicinity of nanoclay layer) (b) both α and β phase, (slightly away from clay layer) (c) amorphous pattern in between two clay layers apart from each other in *NC4* as shown in the main text.

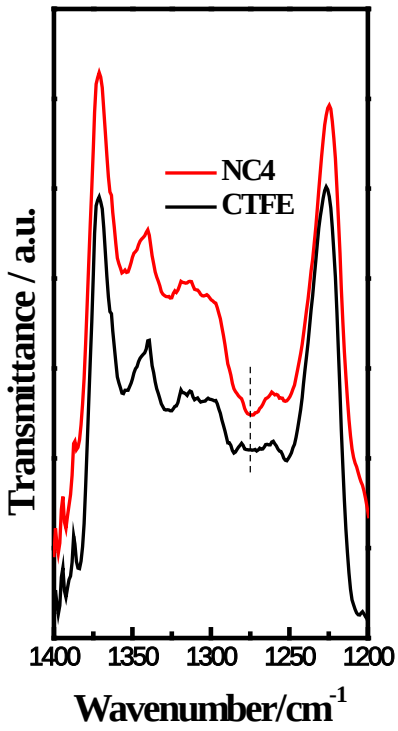

Figure S3: FTIR spectra of CTFE and NC4 showing clear peak at 1275 cm^{-1} is due to β-phase. The said peak is absent in pure CTFE.

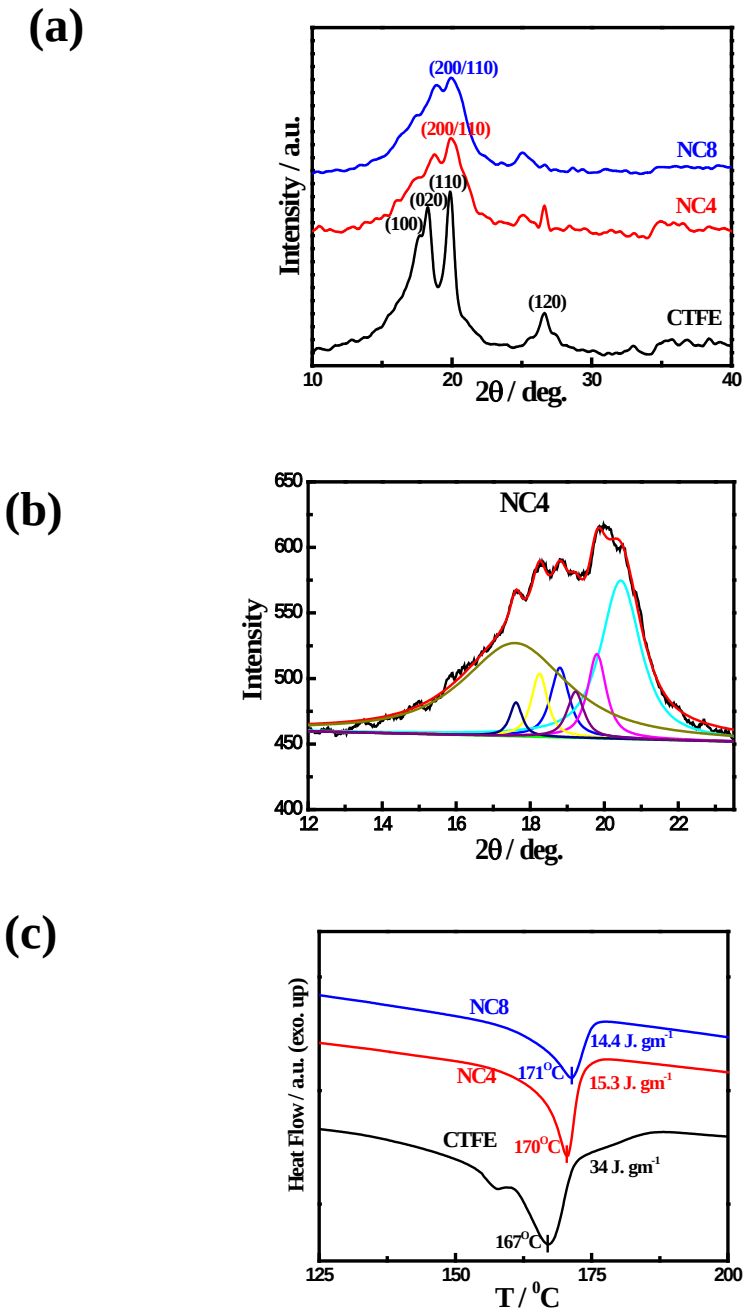

Figure S4: (a) *XRD* patterns of pure *CTFE* and its indicated nanohybrids before irradiation. (b) deconvoluted *XRD* pattern of NC4 indicating different crystalline and amorphous peaks. (c) *DSC* thermograms (melting endotherm) of pure *CTFE* and its nanohybrids (heat of fusion and melting indicated for respective samples). Melting point increase in nanohybrids while heat of fusion decrease suggesting β-phase in *CTFE*.

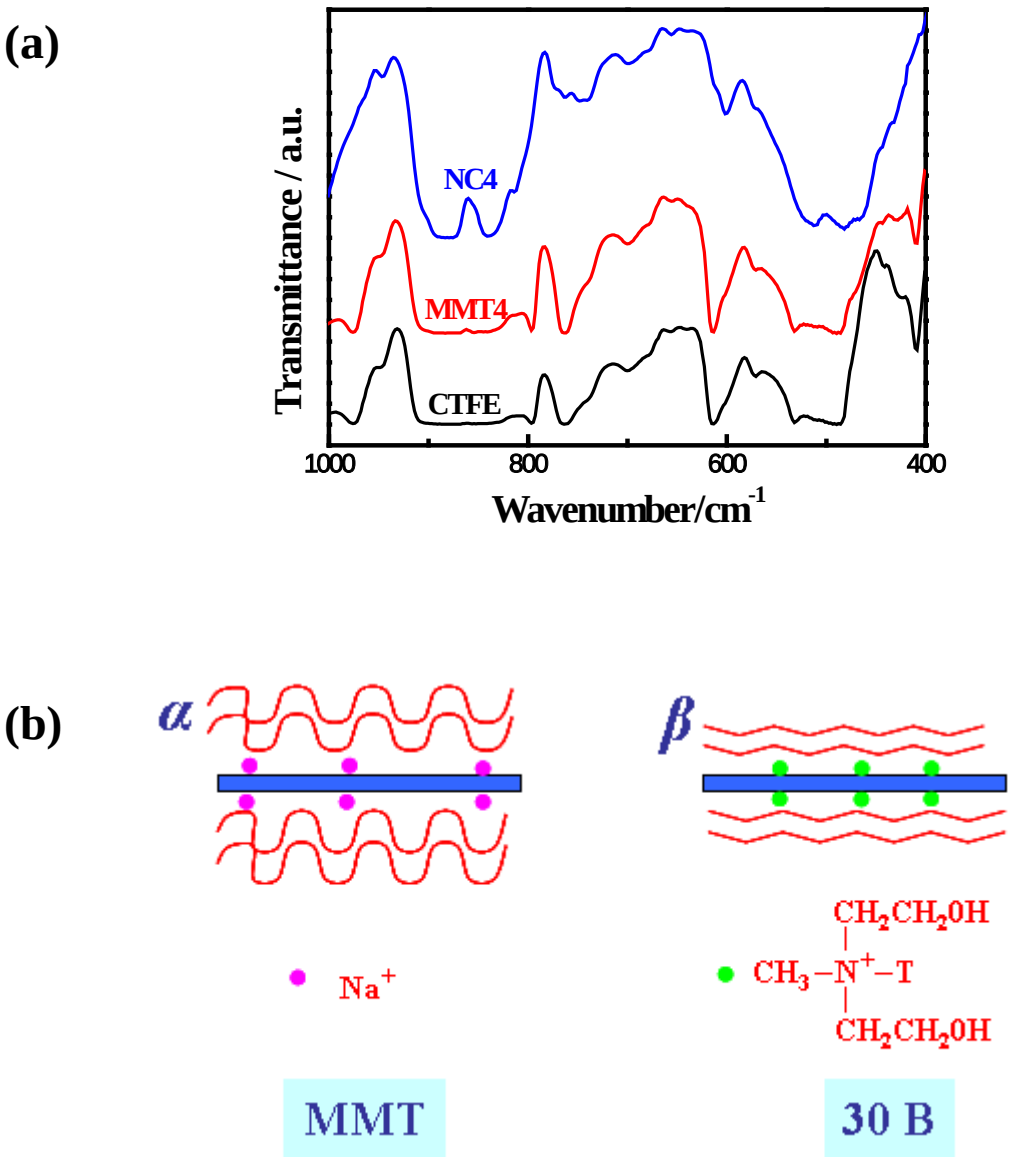

Figure S5: (a) FTIR spectra of nanohybrids comparing MMT clay and 30B showing β-peaks at 510 and 840 cm^{-1} for 30B clay while those peaks are categorically absent in MMT clay compositesn and (b) Schematic diagram showing α-phase crystallization on MMT clay while β-phase crystallize on 30B clay as a result of better interactions in presence of organic modifier.

Supplementary Table 1: The storage modulus of pure *CTFE* and *NC4* at different temperature ranges. The percentage increment was calculated in comparison to pure *CTFE*.

Sample	Temp. (^{o}C)	Storage Modulus / GPa	% increase
CTFE	**-70**	**11.5**	**-**
NC4		**19.5**	**70**
CTFE	**25**	**1.14**	**-**
NC4		**1.60**	**40**
CTFE	**125**	**0.13**	**-**
NC4		**0.21**	**62**

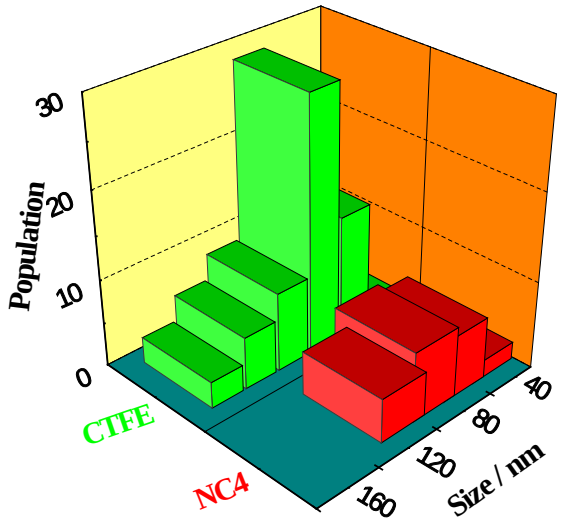

Figure S6: Comparison of Number of pores and its distribution generated after SHI irradiation at fluence 1×10^{10} ion/cm^2 for indicated pure *CTFE* and *NC4* nanohybrid. Both the number density and dimension of pores are larger in pure *CTFE* as compared to nanohybrid. In other words, the shape and size of pores are controlled in nanohybrid.