Supplementary Information

Efficiently synthesized Co doped Cu_3TeO_6 accounted for its anomalous behaviour in electronic properties

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Table S1. Calculated Scherer's crystallite size of $Cu_{3-x}Co_xTeO_6$ (x = 0, 0.1, 0.3 and 0.5) samples showing sizes smaller in doped compounds than in pristine.

Sample	Average crystallite size in nm
Cu_3TeO_6	54
$Cu_{2.9}Co_{0.1}TeO_6$	54
$Cu_{2.7}Co_{0.3}TeO_6$	39
$Cu_{2.5}Co_{0.5}TeO_6$	40

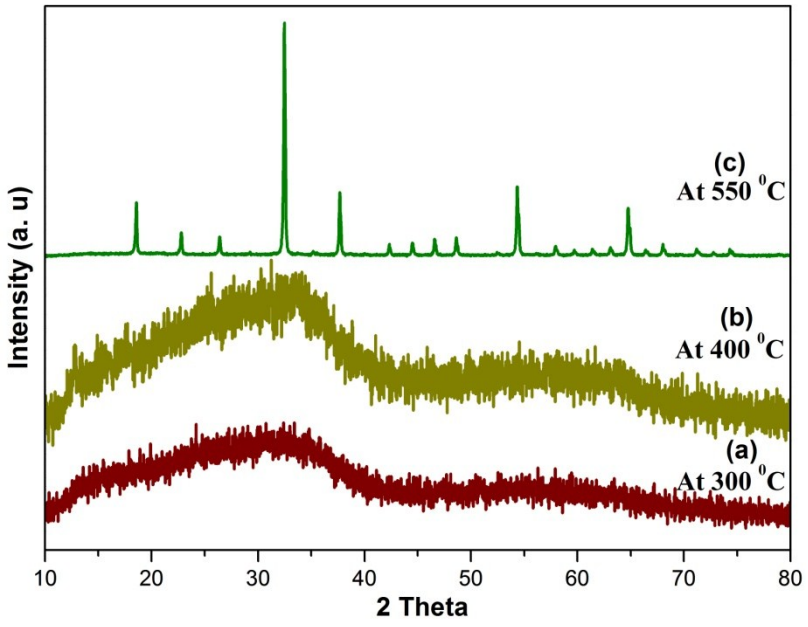


Fig. S1 XRD of precursor Cu_3TeO_6 at different temperature (i.e. 300 °C, 400 °C and 550 °C) showing amorphous to crystalline transformation.

Cu_3TeO_6 show amorphous nature at 300 °C and 400 °C temperatures, which on further heating to 550 °C gains crystallinity.

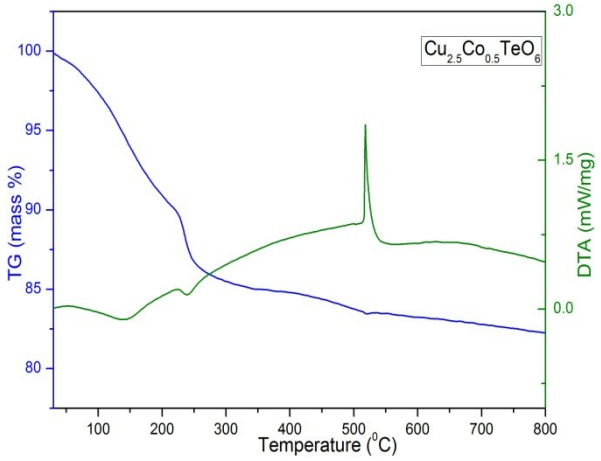


Fig. S2 Thermo-gravimetric (TG) and differential thermal analysis (DTA) curves of precursor of $Cu_{2.5}Co_{0.5}TeO_6$ showing various weight loss processes.

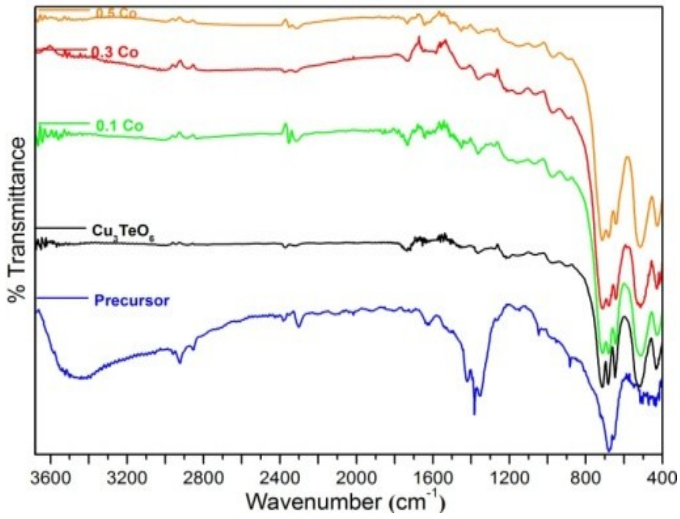


Fig. S3 Infrared (IR) spectra of precursor and final compound of Cu_3TeO_6 and doped series with prominent metal-oxygen bond vibration and absorbed water in precursor sample.

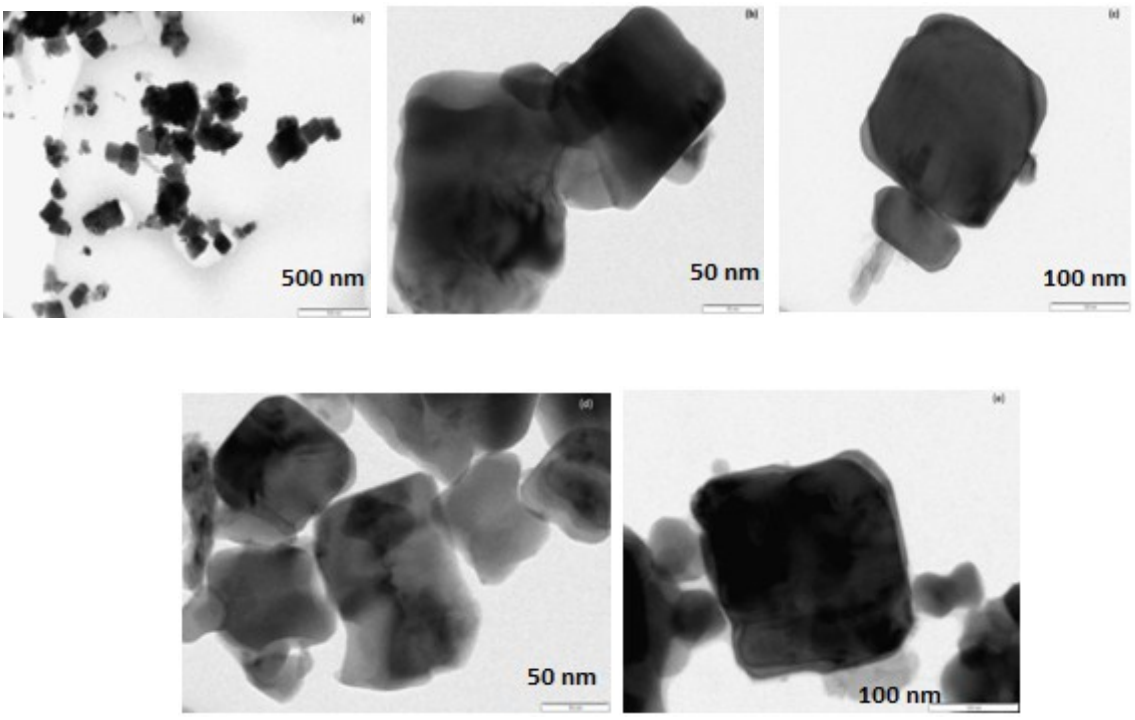
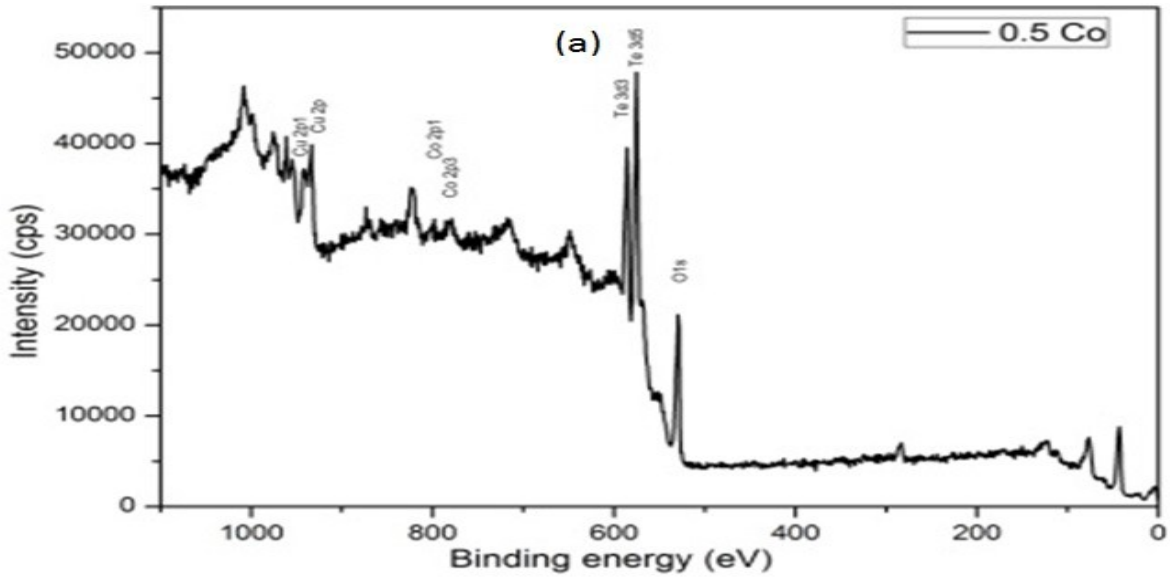


Fig. S4 Transmission electron microscopy (TEM) on $Cu_{2.9}Co_{0.1}TeO_6$ (a, b, c) and $Cu_{2.7}Co_{0.3}TeO_6$ (d, e) samples.



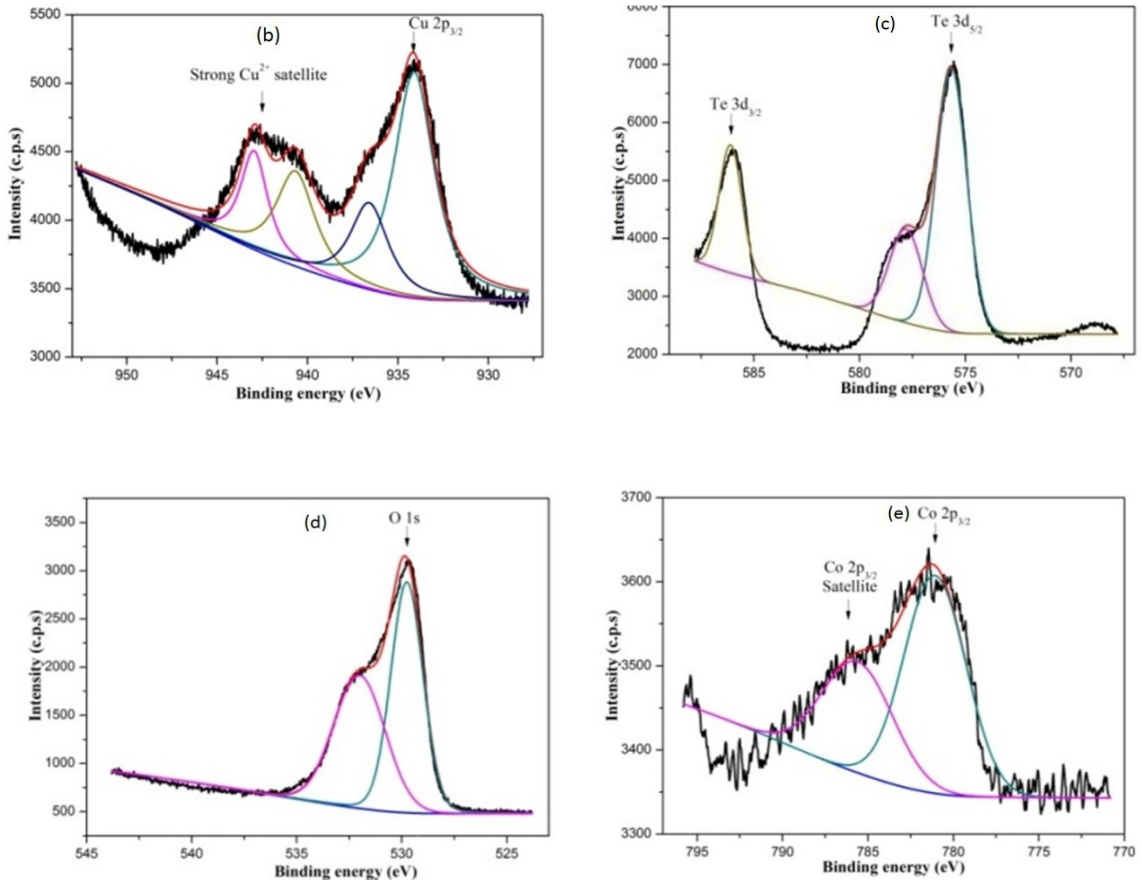


Fig. S5 XPS representing full scan of (a) $Cu_{2.5}Co_{0.5}TeO_6$, (b) Cu (2p), (c) Te (3d), (d) O (1s) and (e) Co (2p) spectra.

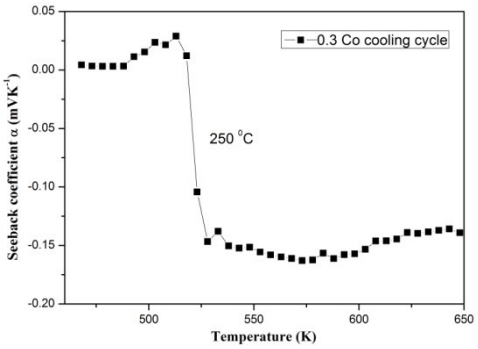


Fig. S6 Variation of Seebeck coefficient with temperature for $Cu_{2.7}Co_{0.3}TeO_6$ sample showing insulator to n-type transition at a critical temperature for cooling cycle.

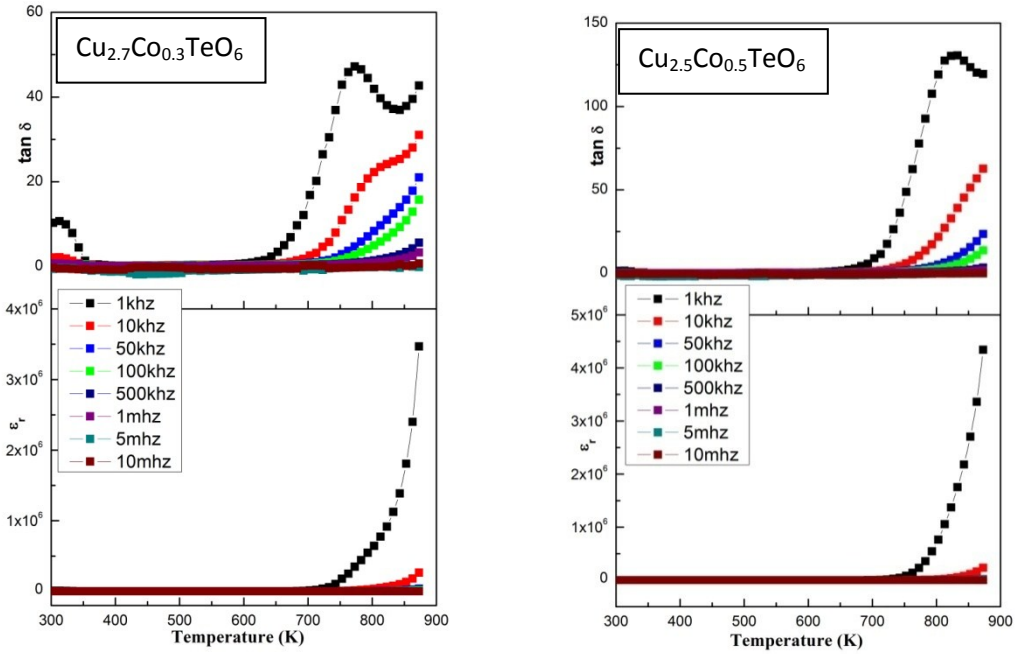


Fig. S7 Frequency and temperature dependent relative permittivity and dielectric loss for $Cu_{2.7}Co_{0.3}TeO_6$ and $Cu_{2.5}Co_{0.5}TeO_6$.

When temperature rises, the orientation of the dipoles takes place facilitating rise in dielectric polarisation. At higher frequencies, the dipoles are not free to orient and hence the polarisation becomes less. The high dielectric loss at low frequencies and high temperature results as polarisation is high at low frequencies as compared to that at higher frequencies.