Electronic Supplementary Material

RATIOMETRIC TEMPERATURE MEASUREMENT USING NEGATIVE THERMAL QUENCHING OF INTRINSIC $BiFeO_3$ SEMICONDUCTOR NANOPARTICLES

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X-Ray Photoelectron Spectroscopy (XPS)

The X-Ray Photoelectron Spectroscopy (XPS) measurements of BFO NPs were performed on AXIS 165 spectrometer (Kratos Analytical). The survey scans were collected for binding energy spanning from 1000 eV to 0 with an analyzer pass energy of 160 eV and a step of 0.4 eV. For the high-resolution spectra, the pass-energy was 20 eV with a step of 0.1 eV. Electron flood neutralizer was applied to compensate for sample charging. The survey spectrum of pure BFO NPs (Figure S1a) confirms the presence of Bi, Fe, and O elements. The main peak at ~529 eV is attributed to the cation oxygen bonds. The peak at ~532 eV corresponds to the presence of oxygen vacancies. The presence of mixed-valence states Fe^{3+} and Fe^{2+} in BFO NPs was revealed by XPS spectra (Figure S1b) which shows two peaks ~ 710 eV and 724 eV indicating that Fe is dominantly in 3+ state. Further, due to the different d orbital electron configuration, the satellite peaks at 8 eV above these peaks indicate the presence of both Fe^{2+} and Fe^{3+} cations. The presence of mixed states is an indicative of the presence of oxygen vacancies (defect states) in the sample.

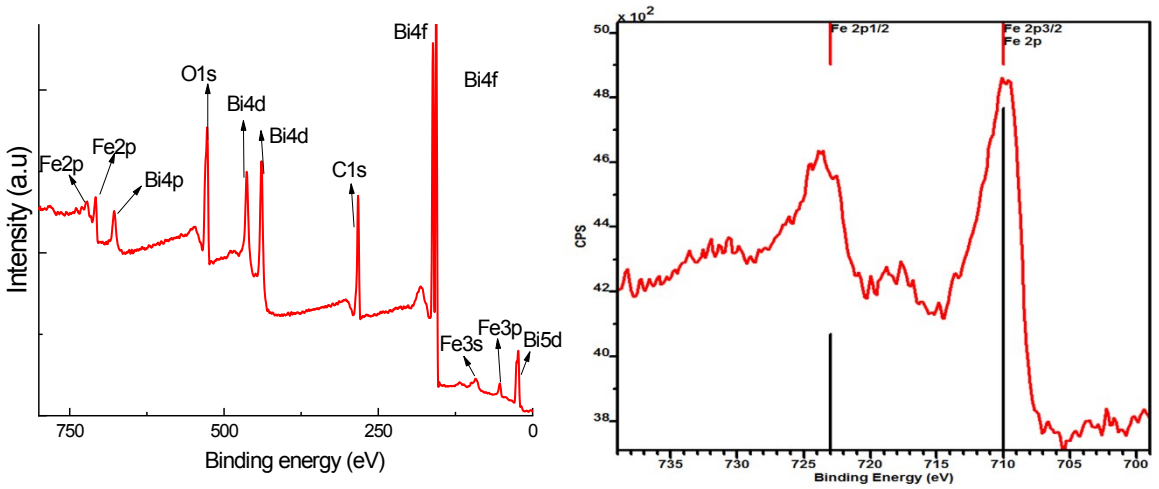

Figure S1 XPS spectra of pure BFO NPs showing: a) the survey spectrum and b) the presence of mixed Fe^{3+} and Fe^{2+} valence states