Supporting Information

Luminescence photoswitching of Ho-doped $Na_{0.5}Bi_{2.5}Nb_2O_9$ ferroelectrics: luminescence readout process

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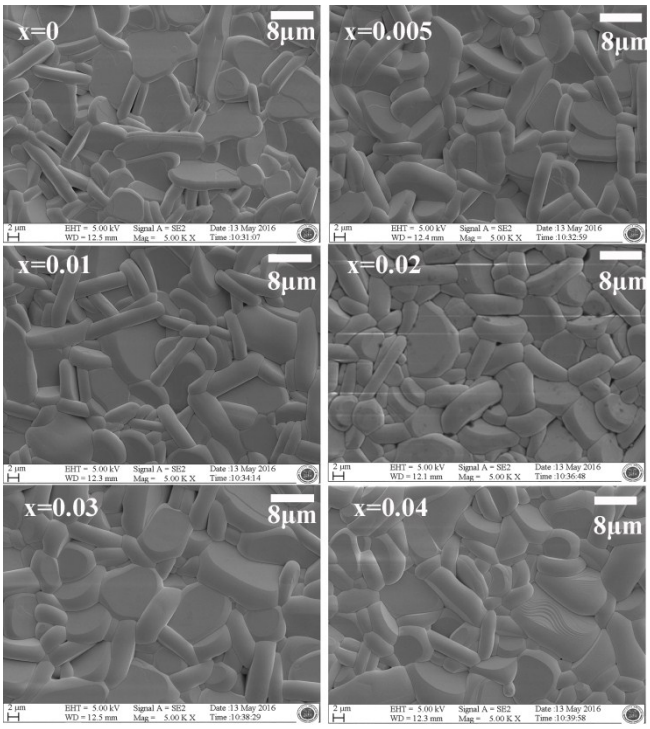

Fig. S1 SEM images of NBN:xHo ceramic samples

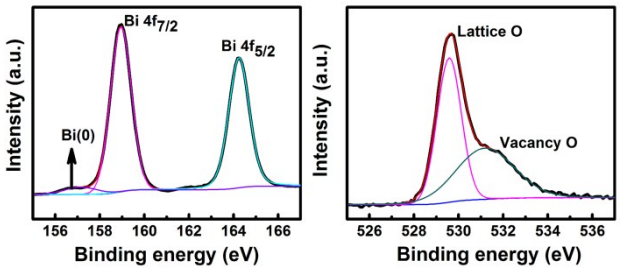

Fig. S2 Bi 4*f* and O 1*s* XPS spectra of the NBN:0.01Ho sample.

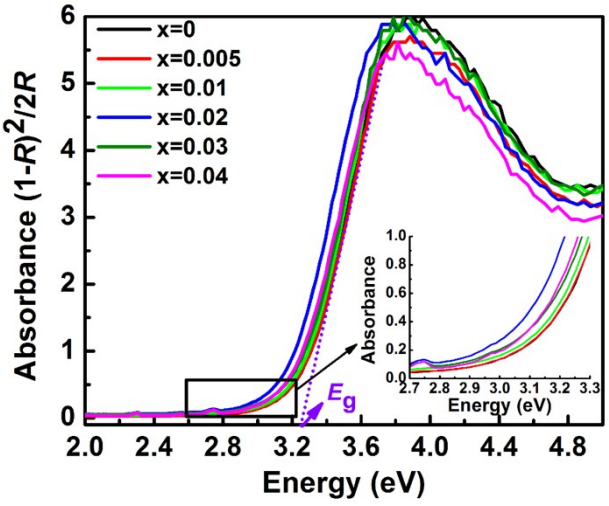

Fig. S3 Absorption spectra of NBN:xHo samples obtained by the conversion of the K-M function.

The inset shows the regionally enlarged drawing.

In Fig. S3, the absorbance data were obtained by a conversion of the reflectance data using a Kubelka-Munk function (K-M) as follows:

$$K / S = \frac{(1 - R)^2}{2R} \qquad (1)$$

Here, the K and S are the absorption and scatting coefficients, respectively. R is the reflectance ratio. The band gap energies (E_g) corresponding to the absorption edge can be obtained by extrapolating the absorption edge onto the energy axis.[1]

[1] B. K. Das, S. J. Bora, M. Chakrabortty, L. Kalita, R. Chakrabarty and R. Barman, J. Chem. Sci. 2006, 118, 487.

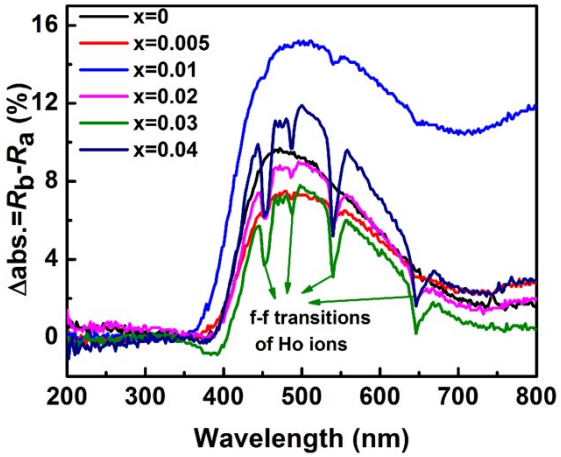

Fig. S4 The difference (Δabs.) between reflectance ratios of NBN:xHo samples before and after 407 nm light irradiation (LD, 200 mW).

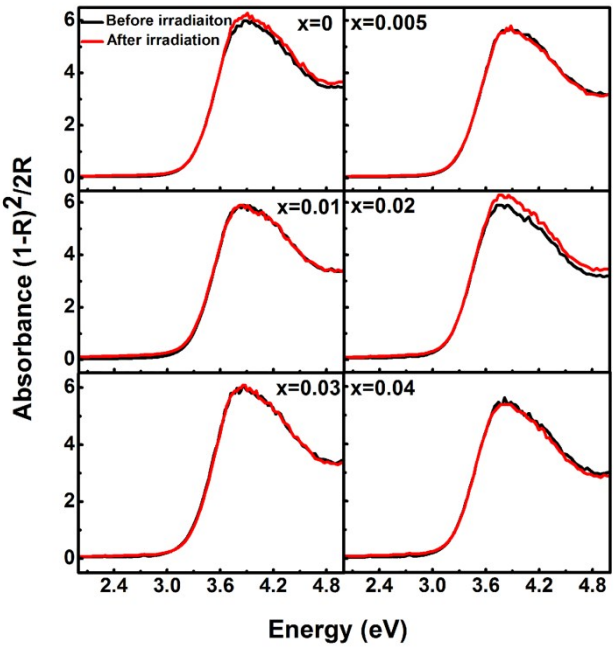

Fig. S5 Absorption spectra of NBN:xHo samples before and after 407 nm light irradiation (LD, 200 mW).

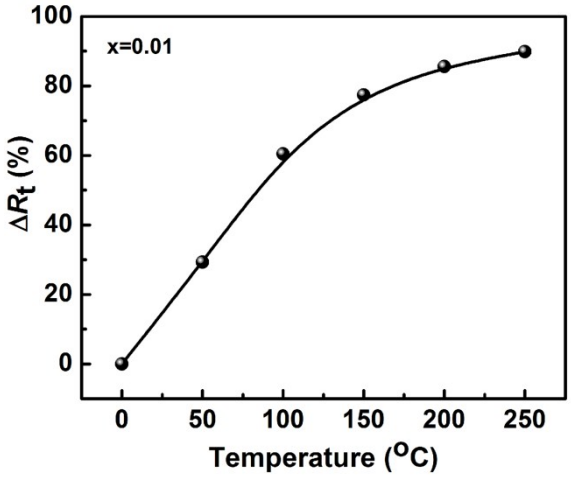

Fig. S6 The ΔR_t values of the NBN:0.01Ho sample as a function of the thermal treatment temperature.

Table S1 Fitting results of Raman spectra (a) before and (b) after 407 nm light irradiation (LD, 200 mW) for all samples.

(a)

Modes	**Samples before irradiation**					
(cm^{-1})	0	0.005	0.01	0.02	0.03	0.04
ν_1	67.21	67.52	67.18	67.27	67.87	66.70
ν_2	81.22	81.56	81.46	81.22	82.11	80.83
ν_3	109.78	110.40	109.79	109.95	110.45	106.86
ν_4	144.77	145.28	144.94	144.95	146.30	148.91
ν_5	182.63	181.73	182.90	181.17	184.15	184.55
ν_6	221.08	220.72	221.11	220.23	221.68	217.18
ν_7	265.96	266.84	266.20	266.31	268.09	263.00
ν_8	328.46	329.94	328.64	330.30	329.39	331.33
ν_9	427.34	426.06	429.52	426.67	428.98	428.31
ν_{10}	574.01	573.60	576.05	572.78	579.36	579.23
ν_{11}	809.35	811.48	810.53	808.77	808.64	807.10
ν_{12}	840.95	842.34	841.92	840.35	840.33	839.21

(b)

Modes	**Samples after irradiation**					
(cm^{-1})	0	0.005	0.01	0.02	0.03	0.04
ν_1	67.32	67.36	67.36	67.43	67.72	66.84
ν_2	81.20	81.43	81.43	81.35	81.98	80.96
ν_3	109.70	109.26	109.26	110.06	110.69	107.06
ν_4	144.85	144.78	144.78	144.99	146.52	148.69
ν_5	182.01	183.10	183.10	180.94	183.61	184.26
ν_6	220.38	220.99	220.99	219.89	221.35	217.13
ν_7	265.34	265.53	265.53	266.25	268.61	263.24
ν_8	328.50	328.82	328.82	330.00	328.71	331.47
ν_9	427.22	429.08	429.08	425.82	429.20	428.30
ν_{10}	574.19	576.40	576.40	572.83	579.95	579.31
ν_{11}	812.30	808.66	807.45	806.93	809.14	808.27
ν_{12}	842.95	840.38	839.87	838.86	840.69	839.97

Table S2 The band gap energies (E_g and E^*_g) of NBN:xHo samples before and after 407 nm light irradiation (LD, 200 mW).

Samples	**x=0**	**x=0.005**	**x=0.01**	**x=0.02**	**x=0.03**	**x=0.04**
E_g (eV)	3.23	3.21	3.20	3.13	3.19	3.16
E^*_g (eV)	3.24	3.22	3.19	3.12	3.18	3.17

E^*_g means the gap after irradiation