Electronic Supplementary Information

Broad bandwidth emission and in situ electric field modulation of photoluminescence in Nd-doped ferroelectric crystals

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Experimental Section:

The Nd-doped ferroelectric crystals (Pb0.97Nd0.03)[(Mg1/3Nb2/3)0.61Ti0.39]O3 [Nd:PMNT] with tetragonal perovskite structure were grown by top-seeded solution-growth method.[1] The plates were sliced along the <001> direction for electrical, photoluminescence performance measurements. The transparent indium tin oxide (ITO) was deposited on both sides of samples using magnetron sputtering system for photoluminescence response measurement. The polarization-electric field (P-E) hysteresis loop and current vs electric field (I-V) curve were measured using a ferroelectric analyzer (TF2000, aix-ACCT, Germany). The piezoresponse images before and after poling through an explanted direct current power source were observed by a piezoresponse force microscopy (PFM, Cypher ES, Asylum Research, USA) using conductive prove (ASYELEC-01, Asylum Research, USA) at room temperature. A UV/V/NIR fluorescence spectrometer (FLS980, Edinburgh Instruments, England) was used to measure photoluminescence (PL) response.
Fig. S1 The ferroelectric polarization-electric field ($P$-$E$) hysteresis loop and the current-electric field ($I$-$E$) curve of Nd:PMNT single crystal. The values of the remanent polarization ($P_r$) and coercive field ($E_C$) were 36.7 $\mu$C/cm$^2$ and 4.91 kV/cm, respectively.

Fig. S2 Schematic diagram of the interaction between Nd$^{3+}$ ions and B-site ions moving from a B$_1$ position to a B$_2$ position, when the 90° domains switching induced by an external electric field.
Fig. S3 The PFM phase image of a Nd:PMNT crystal under (a) zero field (10 μm×10 μm) and (b) a coercive field along the z direction (5 μm×5 μm). The schematic diagram is the distribution of the 180° domain (c) in the virgin sample and (d) under the coercive electric field along the z direction.

Fig. S4 Transmittance of Nd:PMNT crystals under the electric field of 0 kV/cm, $E_C$ and $2E_C$. The transmittance was increased by about 6.4% from 0 kV/cm to $E_C$, and by about 0.6% from $E_C$ to $2E_C$. 
Reference