Supporting information

EXPERIMENTAL SECTION

Sample preparation

A series of BCMS: 0.3%Ce^{3+}, x%Eu^{2+} ($0 \leq x \leq 0.9$) phosphors are synthesized by a high temperature solid phase method, using $BaCO_3$, $CaCO_3$, MgO, SiO_2, CeO_2 and Eu_2O_3 as raw materials. To prepare this series of phosphors, the raw material is first ground with an ethanol solution for about 30 minutes, then the well ground sample is placed in an alumina crucible and calcined at 1400 °C for 240 minutes, with the reaction being carried out under nitrogen and hydrogen. Finally the cooled to room temperature samples are ground again for further analysis.

Characterization

The purity of the phases is examined by XRD (DX-2700BH) and the XRD Rietveld refinement results are calculated by the GSAS program. The morphology and particle size are measured by SEM (Hitachi S-4800) and the diffuse reflectance spectra are measured by a UV-Vis-NIR spectrophotometer (Lambda 750). Photoluminescence (PL) spectra and temperature-dependent PL spectra are measured by an FS5-MCS fluorescence spectrometer, and decay curves and fluorescence quantum efficiency are measured by an Edinburgh FLS-1000 fluorescence spectrometer.

Table S1 Average length data for Ca/Ba-O bonds.

Atom	coordination number	Average bond length (Å)
Ca1/Ba-O	12	2.91
Ca2-O	12	2.90
Ca3-O	9	2.60
Ca4-O	9	2.58
Ca5-O	10	2.67
Ca6-O	10	2.69
Ca7-O	10	2.72
Ca8-O	10	2.81

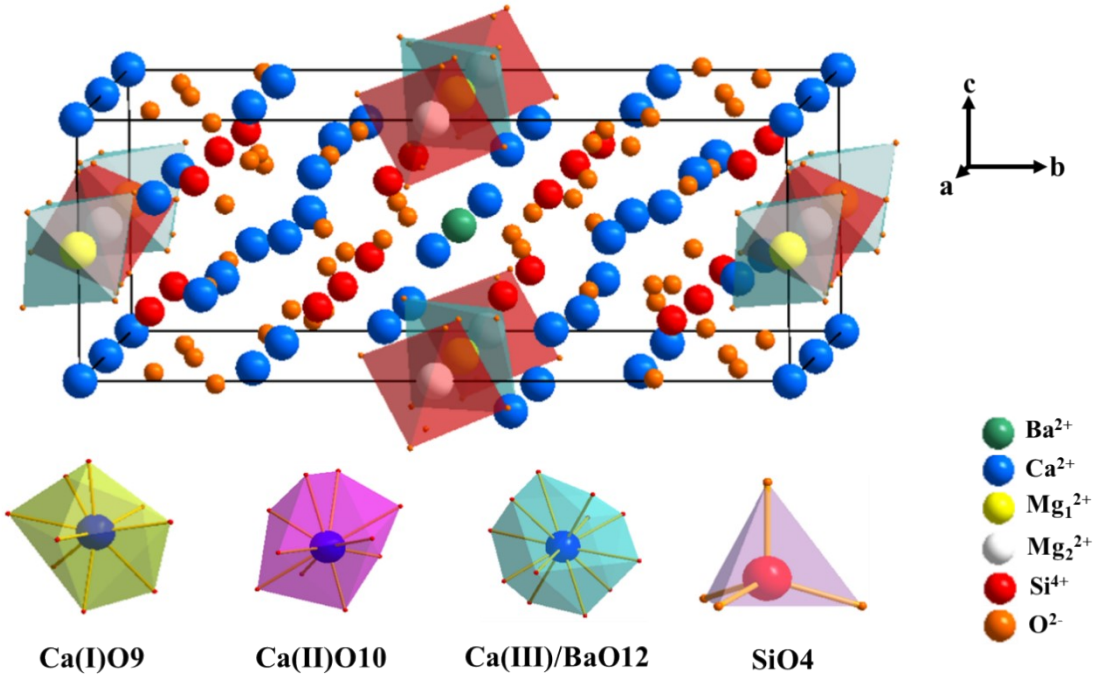

Figure S1. Crystal structure of BCMS phosphor. The inset shows the coordination between all cations and O ions in the BCMS host.

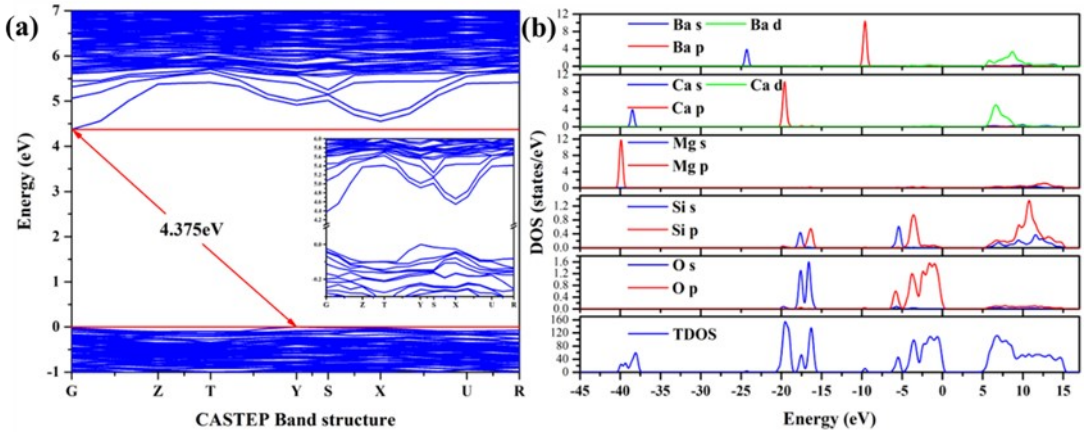

Figure S2. (a) Band structure and the value of band gap of BCMS; (b) Total and partial density of states of BCMS, respectively, calculated using the DFT calculation method.