

Electronic supplementary information

Direct White Light Emission from a Rare-Earth-Free Aluminium-Boron-Carbon-Oxynitride Phosphor

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Table S1 Summary of single component white-emitting-phosphor.

Materials	method	operating condition	Emission	excitation	Quantum efficiency	Ref.
Ba ₃ MgSi ₃ O ₈ :Eu ²⁺ ,Mn ²⁺	solid state reaction	unknown	442, 505, 620 nm	375 nm	unknown	6a)
Sr ₃ MgSi ₂ O ₈ :Eu ²⁺ , Sr ₃ MgSi ₂ O ₈ :Eu ²⁺ , Mn ²⁺	solid-state reaction	1250°C for 4 h under H ₂ /N ₂ atmosphere	470, 570, 680 nm	375 nm	unknown	6b)
Porous Zinc Gallophosphate	hydrothermal	160 °C for 7 days and heated at 280 °C for 4 h	433, 550 nm	390 nm	unknown	6c)
Sr ₃ B ₂ O ₆ :Ce ³⁺ ,Eu ²⁺	solid state reaction	900–1000 °C under 15% H ₂ /Ar atmosphere	434, 574 nm	351 nm	unknown	6d)
Sr ₃ Al ₂ O ₅ Cl ₂ :Ce ³⁺ ,Eu ²⁺	solid-state reaction	1250 °C for 2 h under CO atmosphere	444, 609 nm	330 nm	unknown	6e)
Ca ₉ Gd(PO ₄) ₇ :Eu ²⁺ ,Mn ²⁺	solid state reaction	1200°C for 4h under H ₂ /N ₂ atmosphere	490, 645 nm	254-430 nm	unknown	1
Ca ₃ Y(GaO) ₃ (BO ₃) ₄ :Ce ³⁺ ,Mn ²⁺ ,Tb ³⁺	solid-state reaction	1000°C for 8 h under H ₂ /N ₂ atmosphere	409, 589 nm	365 nm	unknown	6f)
Ca ₄ Y ₆ (SiO ₄) ₆ O: Ce ³⁺ /Mn ²⁺ /Tb ³⁺	solid state reaction	1350 °C for 2 h	410, 614 nm	284-424 nm	13-30%	7
LiSr ₄ (BO ₃) ₃ :Ce ³⁺ , Eu ²⁺	solid-state reaction	1227 °C for 15h under H ₂ /N ₂ atmosphere	430, 612nm	350 nm	unknown	6g)
Na(Sr,Ba)PO ₄ :Eu ²⁺ , Mn ²⁺	solid-state reaction	1150 °C for 10 h under H ₂ /N ₂ atmosphere	440-450, 600 nm	390 nm	unknown	6h)
Dy ³⁺ -activated Ba ₃ Bi(PO ₄) ₃	solid-state reaction	1250 °C for 3 h	487, 575 nm	393 nm	unknown	6i)
CaScAlSiO ₆ :Ce ³⁺ ,Tb ³⁺ ,Mn ²⁺	solid state reaction	1400 °C for 4 h under H ₂ /N ₂ atmosphere	380, 542, 574, 670 nm	330 nm	unknown	6j)
Ca ₂ YF ₄ PO ₄ :Eu ²⁺ ,Mn ²⁺	solid state reaction	1000 °C for 10 h in H ₂ /N ₂	570 nm	375 nm	17.1-22%	6k)

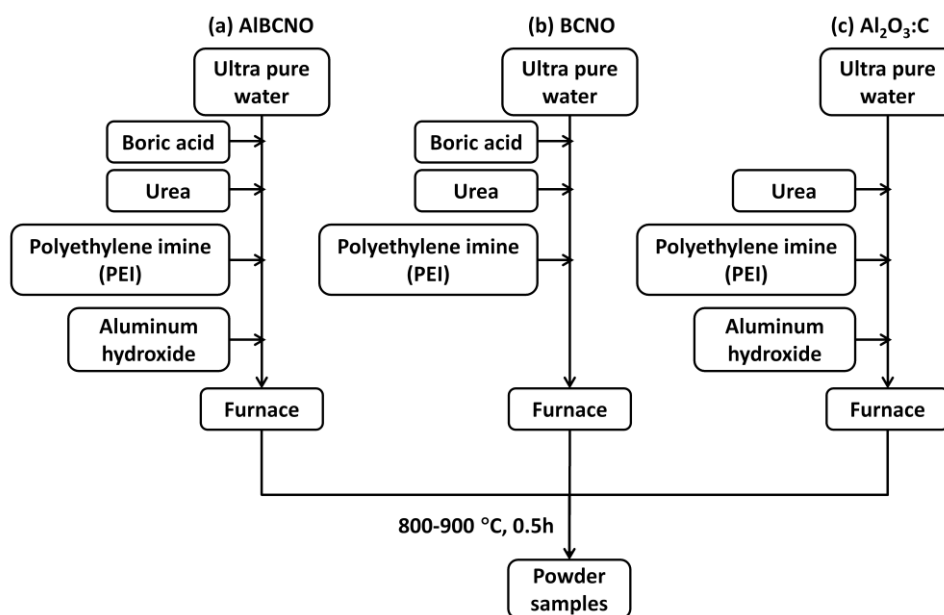


Figure SI-1 Experimental method.

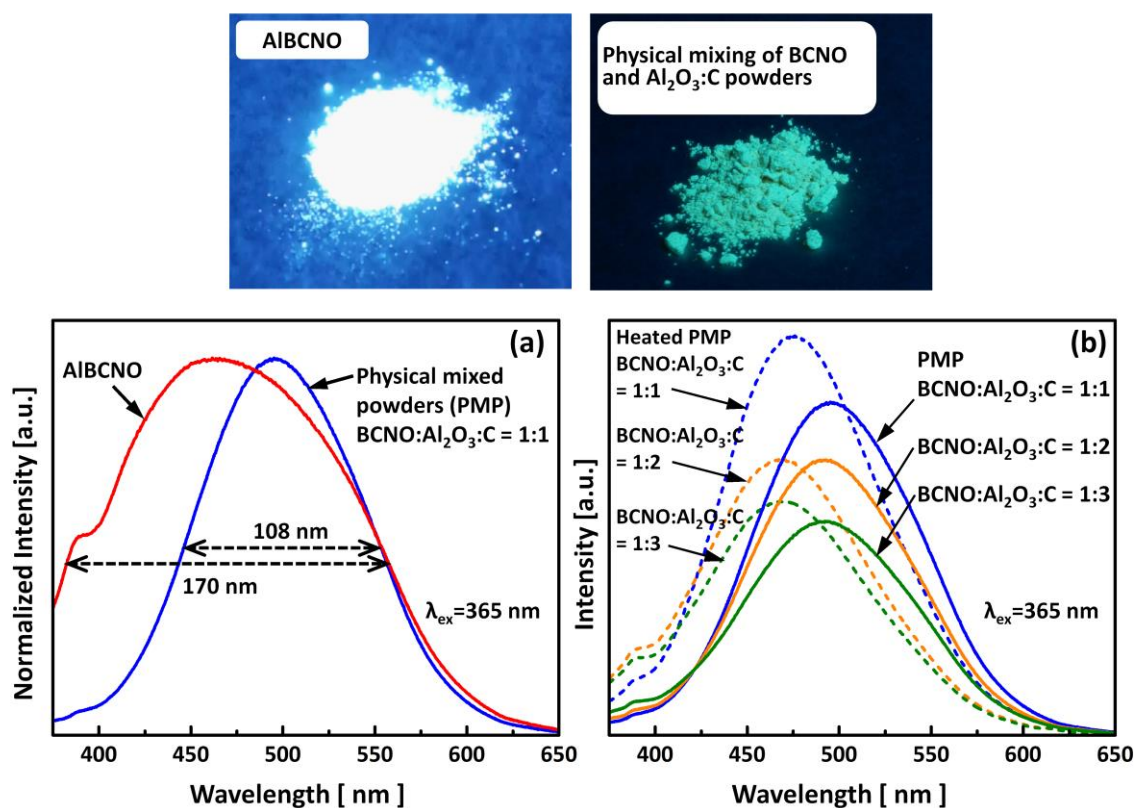


Figure SI-2 (a) Comparison of the photoluminescence properties between the AIBCNO phosphor and the physically mixed powder sample of the BCNO and $\text{Al}_2\text{O}_3\text{:C}$ powders, (b) Effects of mixing ratios and heating (800°C , 30 min) on the photoluminescence properties.

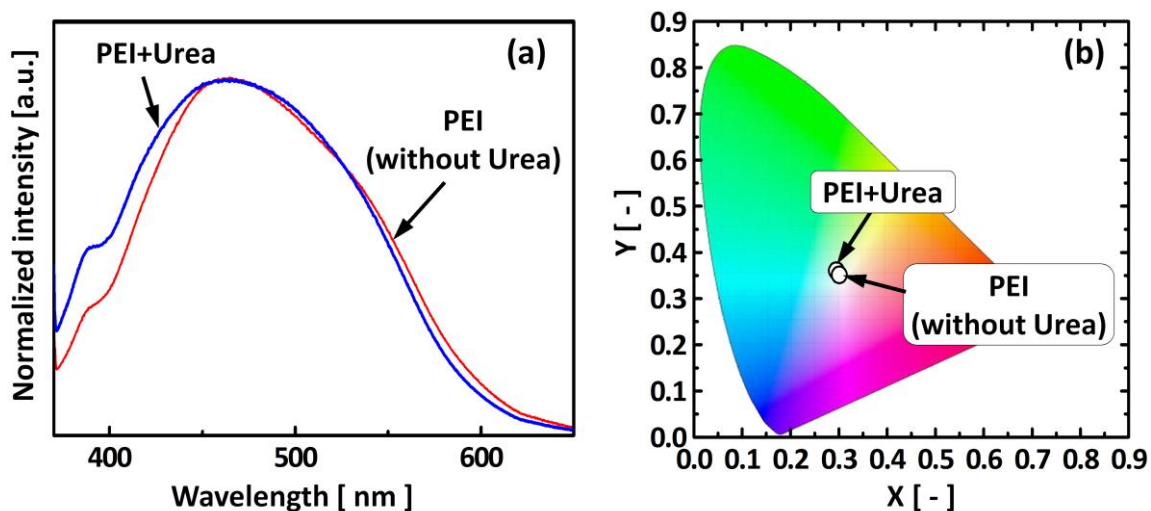


Figure SI-3 Effect of urea on the PL properties. Emission spectra (a) and colour diagram (b). Synthesis temperature: 800°C .

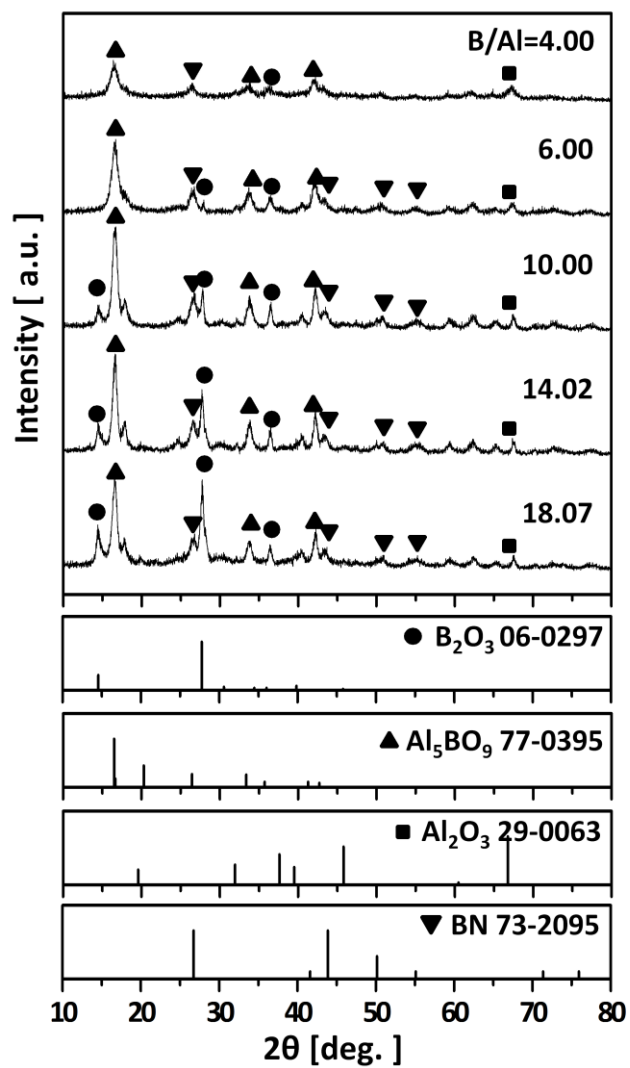


Figure SI-4 Effect of the B/Al ratio of the AIBCNO phosphor samples on the crystal structures.