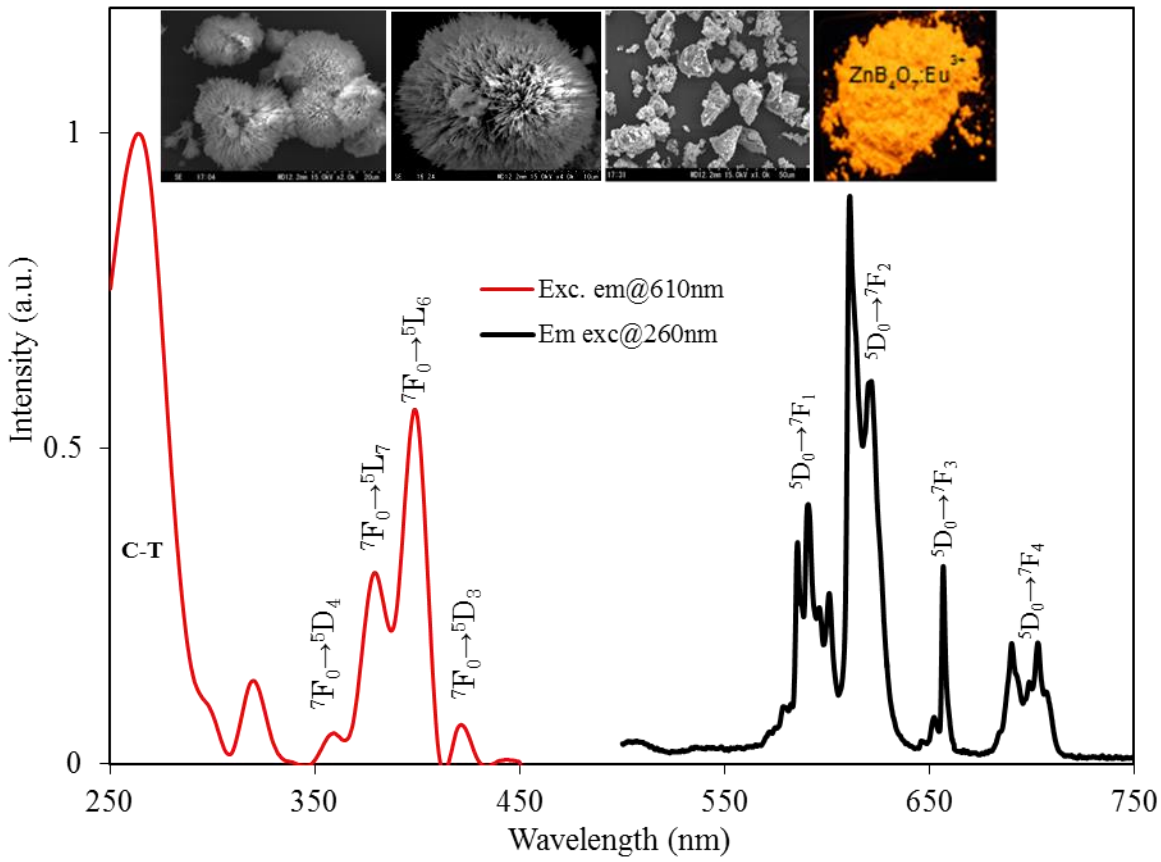
Graphical abstract



Highlights

- $ZnB_4O_7:Eu^{3+}$ phosphor was synthesized by hydrothermal method for the first time.
- Urchin like nanostructure composed of nanorods was achieved during HT treatment.
- The nanorods are 200 to 400 nm while urchins are few µm to 40 µm.
- Phase transition temperature from ZnB_4O_7 to ZnB_2O_4 was determined to be 798 ^oC.
- Bright orange-red emission was observed by UV or blue light excitation.
- High thermal stability and better absorbance was observed than the commercial red phosphor indicating good candidate for UV or blue light excited LEDs.