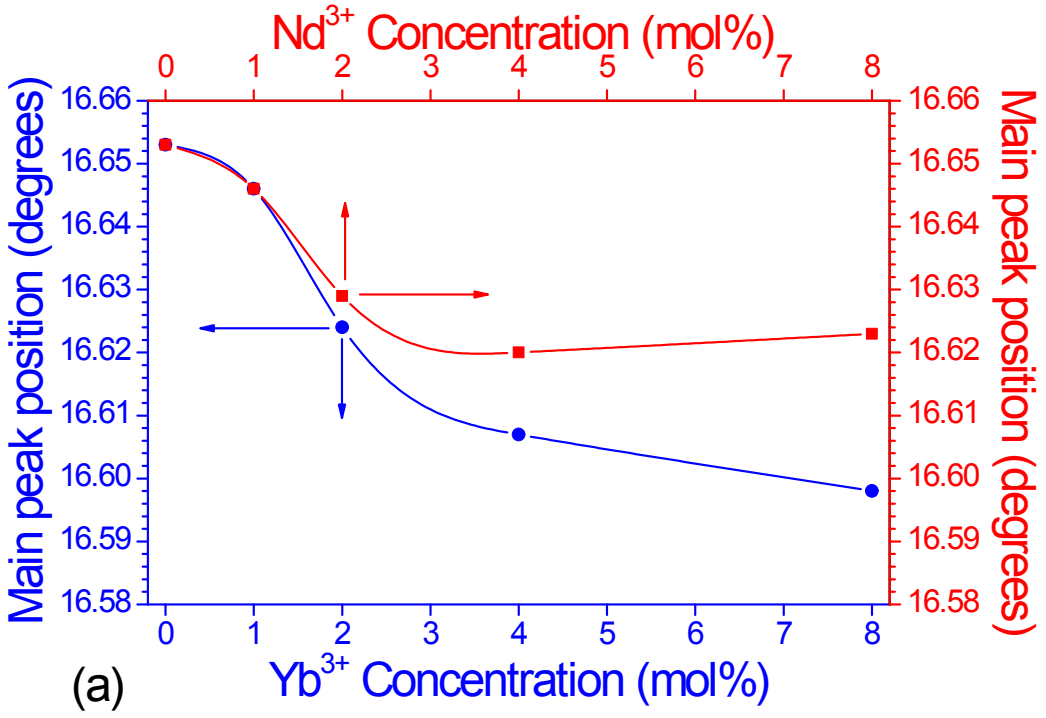
Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supplementary Information

Structural and luminescence properties of Nd^{3+}/ Yb^{3+} codoped $Al_4B_2O_9$ nanocrystalline powders

Figures S1(a) and (b) show the position and FWHM of the main X-ray diffraction peak at ~16.6°, respectively. The data were obtained from the XRD results shown in the Figures 1(a) and (b). Note that the diffraction peak position changes to smaller angles while increasing the Nd^{3+} or Yb^{3+} contents, between 0 and 4 mol%. Also, Figure S1(c) illustrate the *b*/*c*, *a*/*c*, and *b*/*a* cell parameters ratios as a function of the Yb^{3+} or Nd^{3+} concentration calculated from the results in Figure 1(d). Notice that the *b* parameter is more influenced than *c* and *a*. These results indicate that the rare-earth (RE) ions are incorporated into the crystalline phase. On the other hand, the FWHM becomes larger by increasing the concentration of the RE ions. It indicates that the incorporation of the RE ions affects the nanocrystals size in a way that higher concentrations of Nd^{3+} and Yb^{3+} lead to smaller nanocrystals.



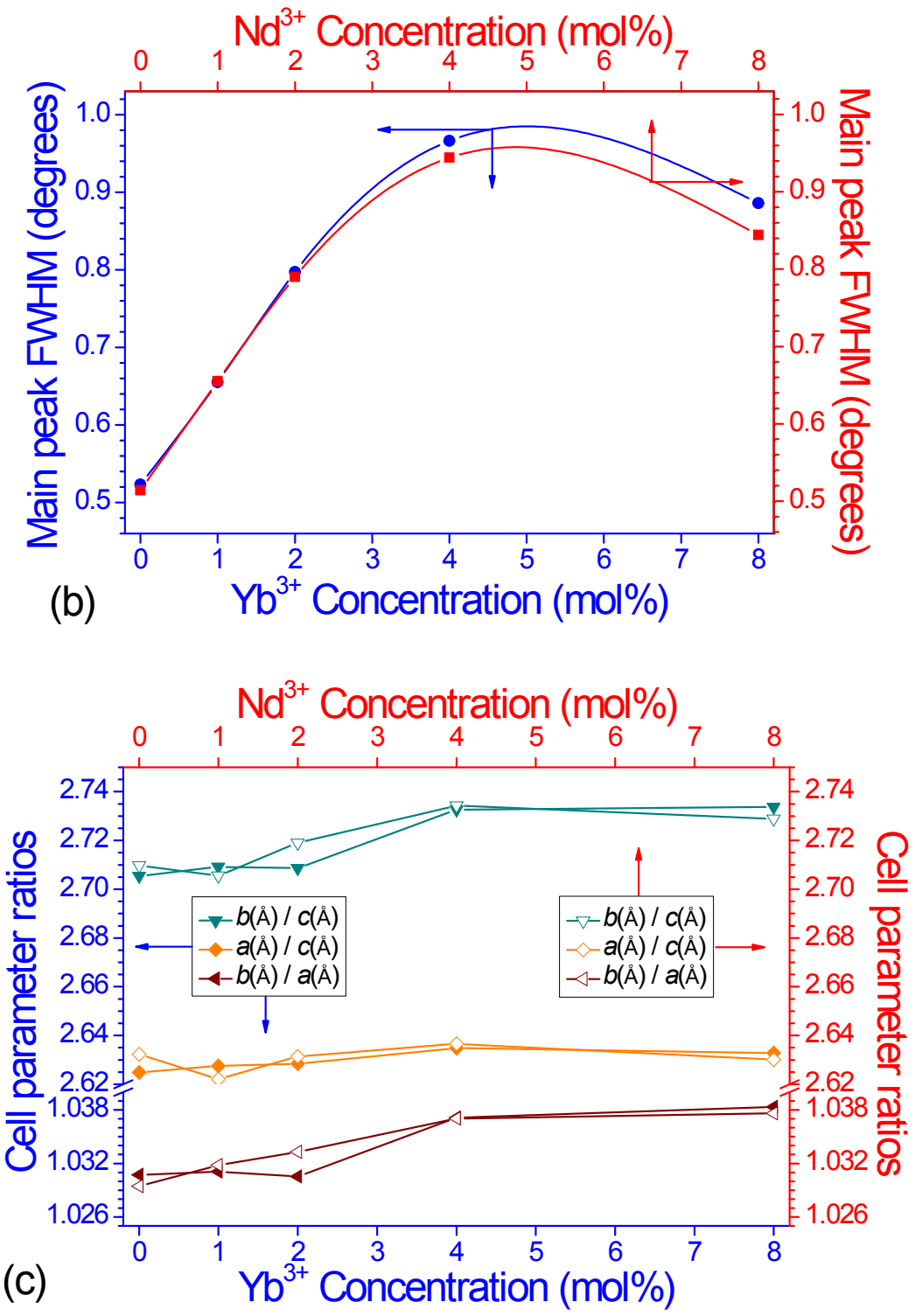
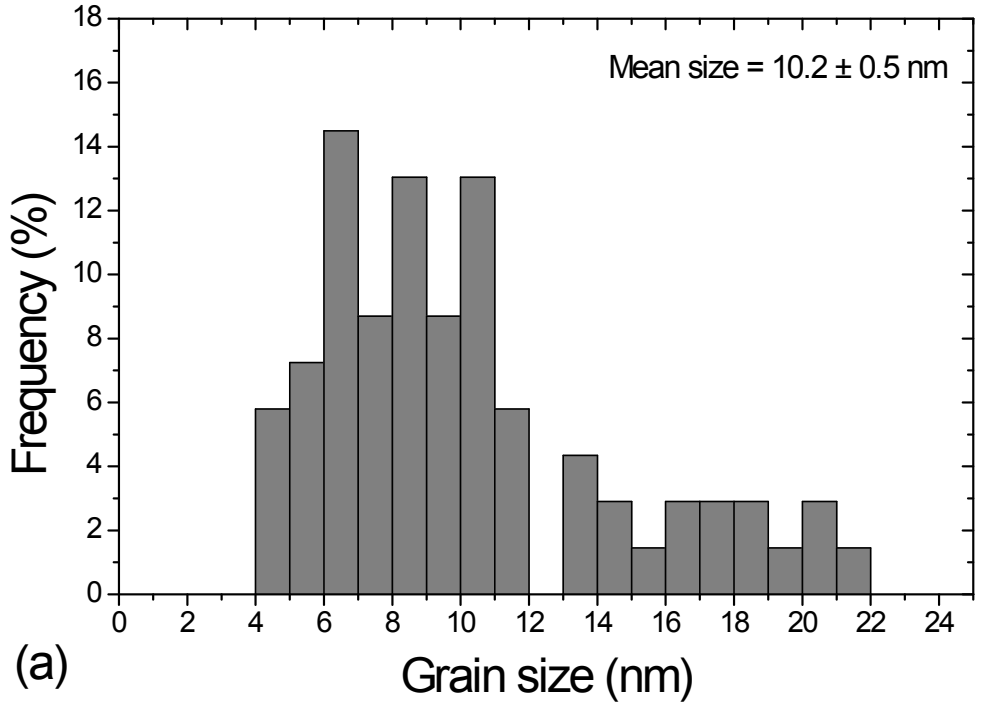


Figure S1: Values of the position (a) and FWHM (b) of the main diffraction peak around 16.6° (a) obtained from the X-ray patterns in the Figures 1(a) and (b) for $Al_4B_2O_9$ phase. (c) *b*/*c*, *a*/*c*, and *b*/*a* cell parameters ratios as a function of the Yb^{3+} or Nd^{3+} concentration calculated from results shown in Figure 1(d).

Figures S2(a) and (b) show the grain size values obtained by the HRTEM images for $Al_4B_2O_9$ powder heat-treated at 900 ^oC and doped with $1Nd^{3+}/2Yb^{3+}$ and $2Nd^{3+}/1Yb^{3+}$, respectively. The sample with $1Nd^{3+}/2Yb^{3+}$ presents grains with dimensions ranging from 4.8 to 21.2 nm and average size of 10.2 ± 0.5 nm. On the other hand, the $2Nd^{3+}/1Yb^{3+}$ doped grains present sizes ranging from 2.9 to 20.1 nm and the average size is 9.3 ± 0.8 nm. The average sizes measured by HRTEM are well correlated with the crystallite sizes determined from the XRD measurements presented in Figure 1(c) of 10.3 nm for $1Nd^{3+}/2Yb^{3+}$ doping, and 10.4 nm for $2Nd^{3+}/1Yb^{3+}$ doping.



(a)

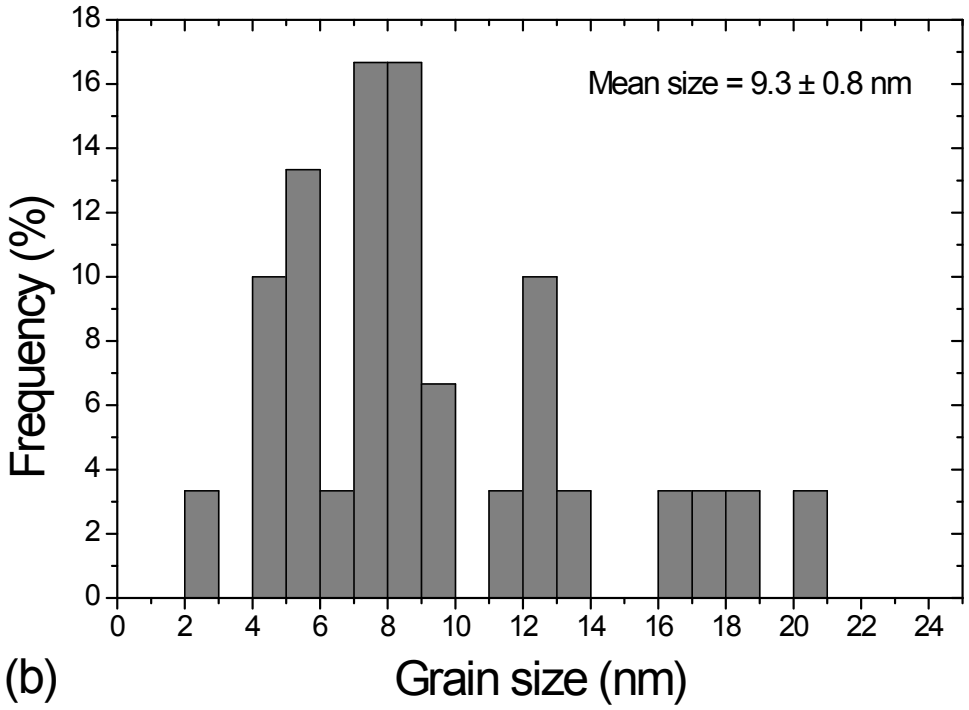


Figure S2: Size distribution of the power grains of $Al_4B_2O_9$ heat-treated at 900 ^oC for (a) $1Nd^{3+}/2Yb^{3+}$, and (b) $2Nd^{3+}/1Yb^{3+}$ doping.

Figures S3(a) and (b) show the as collected photoluminescence emission spectra under excitation at 804 nm, for different Yb^{3+} and Nd^{3+} concentrations, respectively.

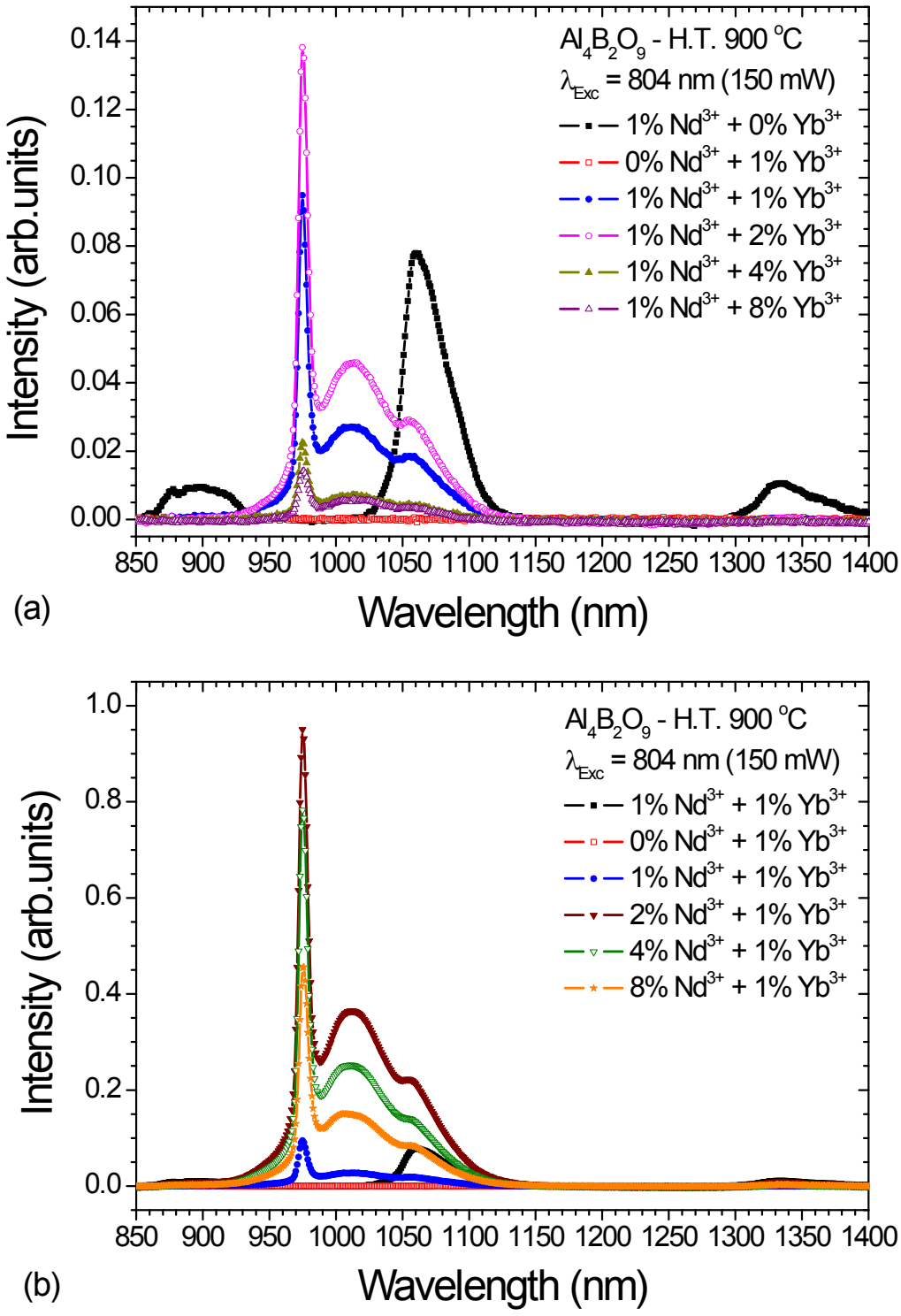


Figure S3: Photoluminescence (PL) spectra of $Al_4B_2O_9$ powders heat-treated at 900 °C: (a) with 1 Nd^{3+} mol% and changing the Yb^{3+} concentration; (b) with 1 Yb^{3+} mol% and changing the Nd^{3+} concentration. All spectra were measured at room temperature under excitation at 804 nm.