Supplementary Information (SI) for Journal of Materials Chemistry C.


# Supporting information :

## Investigation on the role of nitrates in the microwave-assisted autoclave Pechini synthesis of aluminoborate phosphors

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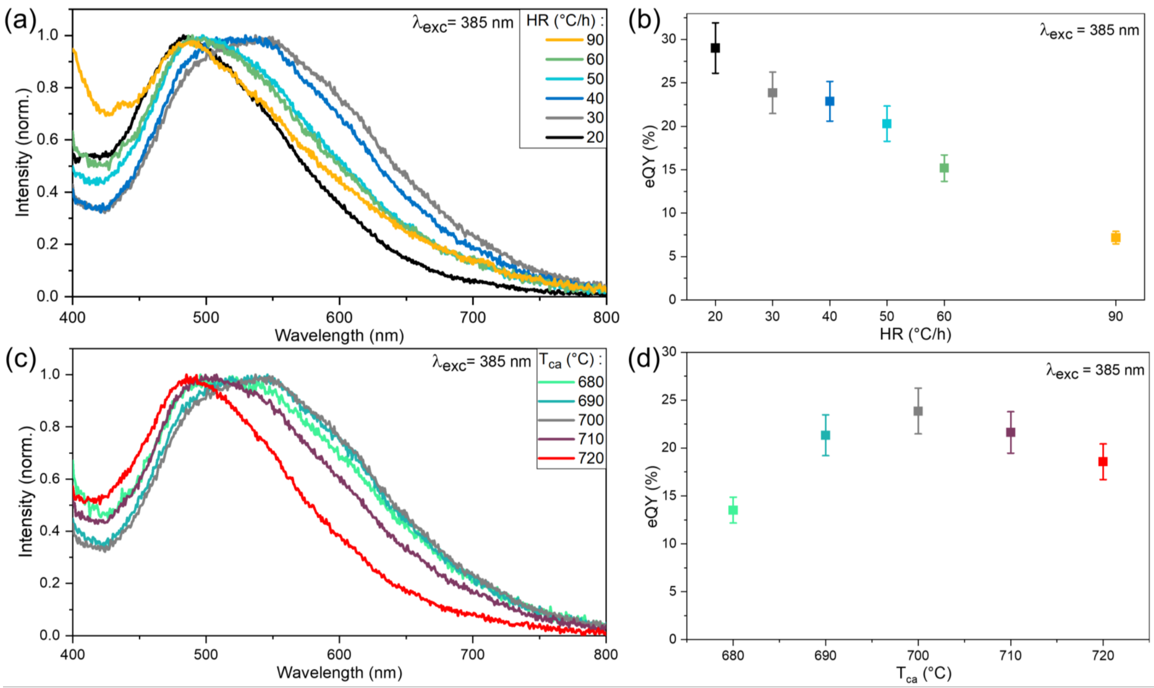


*Figure S1. (a) Normalized emission spectra under 385 nm obtained for different heating rates during the calcination until 700°C of the pyrolyzed AB powder following the MW synthesis (b) associated external quantum yields. (c) Normalized emission spectra under 385 nm excitation obtained for different calcination temperatures during calcination treatment led at the optimized heating rate HR = 30°C/h (d) associated external quantum yields*

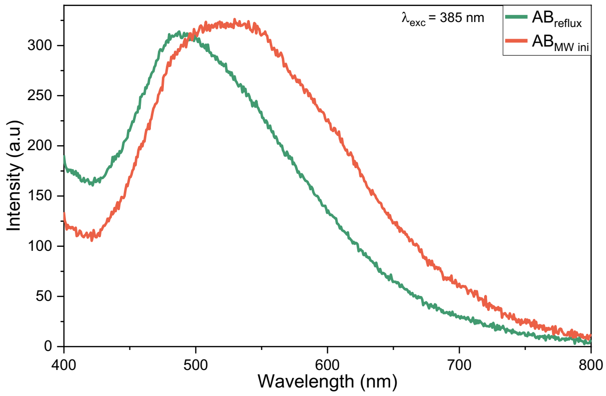


*Figure S2. Emission spectra of the optimized reflux-heated powder and MW powder obtained with the same synthesis parameters under 385 nm excitation*

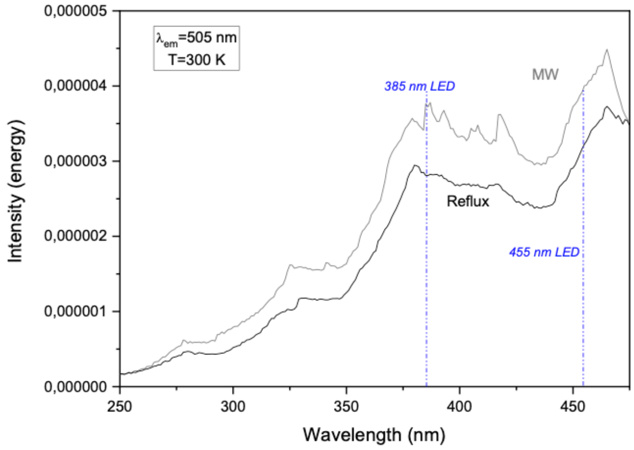


*Figure S3. Excitation spectra of powders obtained by conventional reflux heating ($AB_{reflux}$) and microwave heating ($AB_{MW}$). Both powders can be excited over a wide wavelength range, including the emission wavelengths of conventional commercial LEDs emitting in the near-UV (385 nm) or blue (455 nm) wavelengths.*

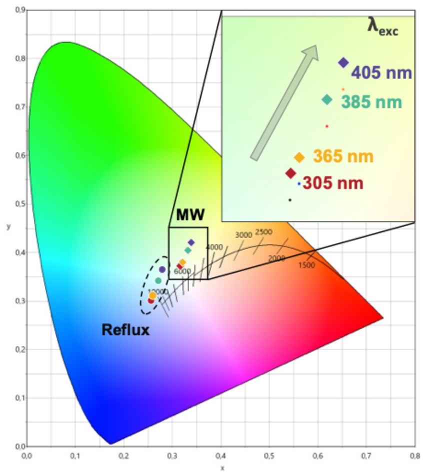


*Figure S4. Trichromatic coordinates on the CIE diagram of heating $AB_{reflux}$ powder surrounded by dotted line and $AB_{MW}$ powder surrounded by solid lines (and in inset) recorded at $\lambda_{exc}$ = 305; 365; 385 and 405 nm.*

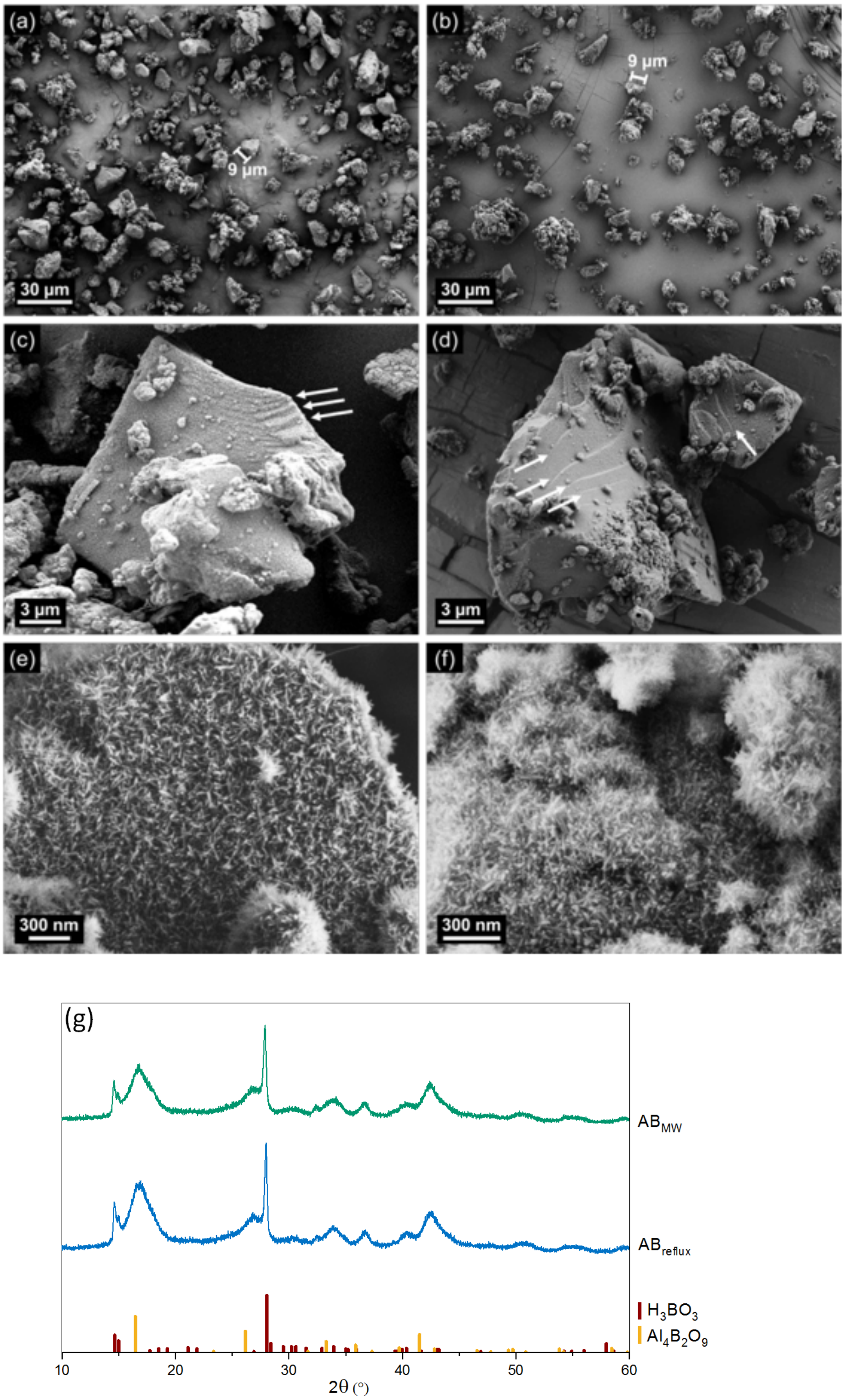


*Figure S5. SEM images of (a)(c)(e) $AB_{reflux}$ and (b)(d)(f) $AB_{MW}$ calcined powders and (g) corresponding powder-XRD patterns*

*Figure S6. Photograph of the brownish fumes, corresponding to the $NO_x$ gases released during the reflux heating*

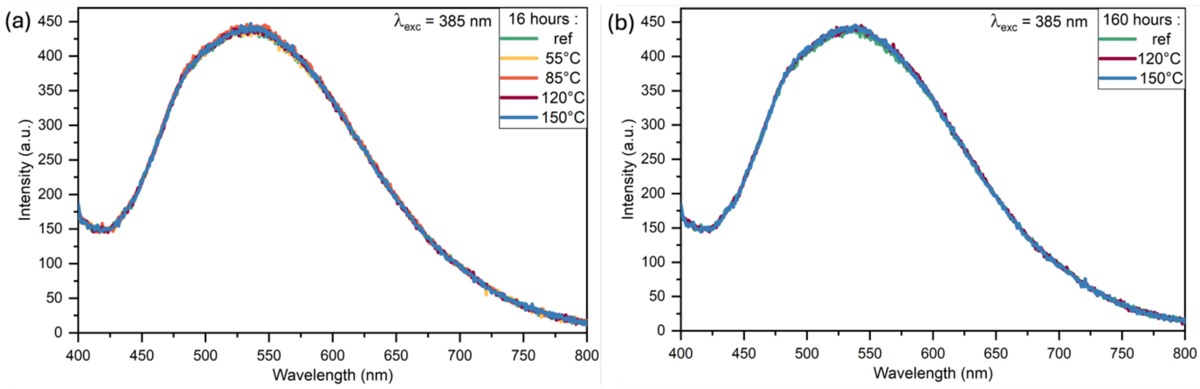


*Figure S7. Emission spectra of $AB_{MW}$ powder (a) after 16 hours in the oven at different temperatures and (b) after 160 hours ($\lambda_{exc}$ = 385 nm) compared to the referent powder (ref) before aging. the emission spectra are all identical regardless of the heat treatment carried out (temperature and duration). The powder synthesized using MW-assisted autoclave heating is thermally stable.*

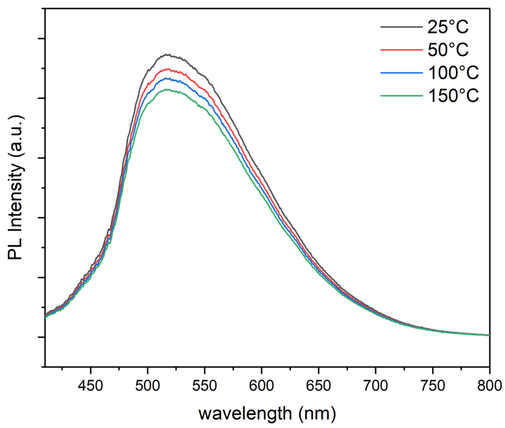


*Figure S8. Temperature-dependent emission spectra of $AB_{MW}$ powder ($\lambda_{exc}$ = 375 nm) recorded between 25°C and 150°C.*

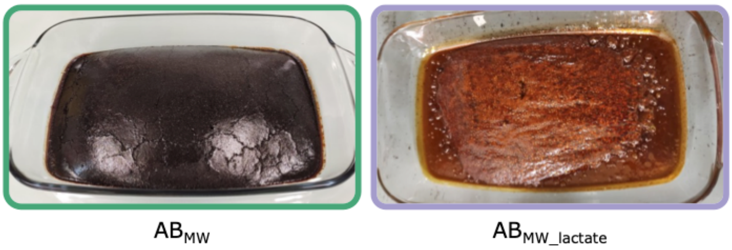


*Figure S9. Photographs of the brown solids evidencing the expansion differences with (left, well-expanded) or without (right, non-expanded) the use of nitrate in the precursors.*

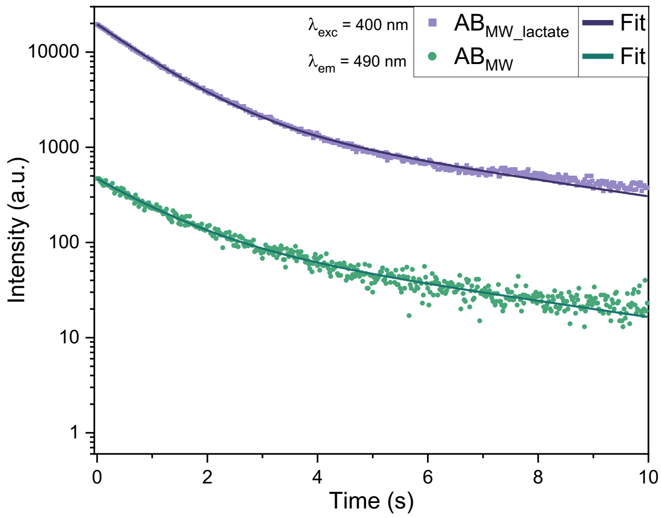


*Figure S10. Room temperature decay curves recorded on AB$_{MW}$ and AB$_{MW_Lact}$ powders monitoring the blue emission at $\lambda_{em}$=490 nm (phosphorescent signal) under 400 nm excitation*

*Table S1: Fit parameters obtained from the fluorescence decays of AB$_{MW}$ and AB$_{MW_Lact}$ powders under 400 nm excitation for 490 nm emission*

| Sample | $\lambda_{em}$ (nm) | $\tau_1$ (s) | $\tau_2$ (s) | $A_1$ (%) | $A_2$ (%) | $R^2$ |
|---|---|---|---|---|---|---|
| AB$_{MW_lact}$ | 490 | 1,0 ± 0,1 | 5,1 ± 0,1 | 89 | 11 | 0,9996 |
| AB$_{MW}$ | 490 | 1,1 ± 0,1 | 5,2 ± 0,1 | 76 | 24 | 0,9901 |

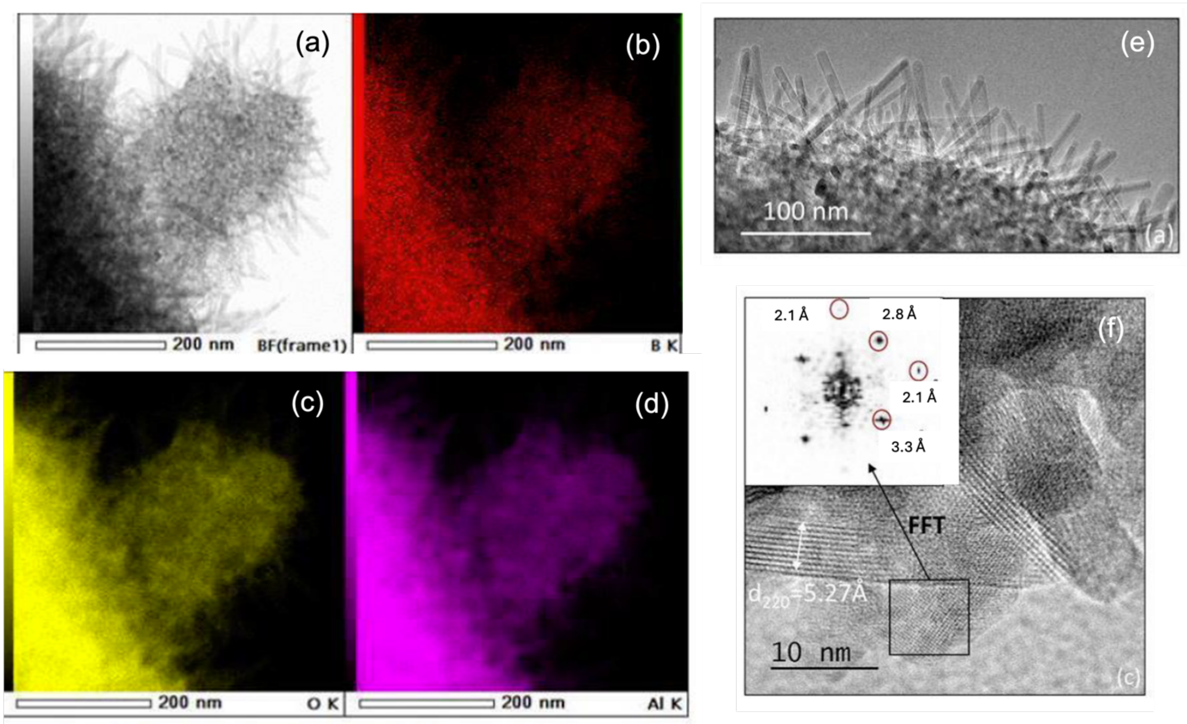


*Figure S11. Image (a) and EDS maps obtained by STEM (acceleration voltage of 200 kV) of an $AB_{MW}$ particle ($T_{ca}$ = 700 °C) showing that the distribution of the B (b), Al (c), and O (d) elements is homogeneous. TEM image of the surface of $AB_{MW}$ particle ($T_{ca}$ = 700 °C) (e) and High-resolution image of surface nanowires (f) with FFT treatment shown in insert. The indexing unambiguously shows the $Al_4B_2O_9$ phase, in good agreement with the XRD pattern (PDF card 04-012-8918).*

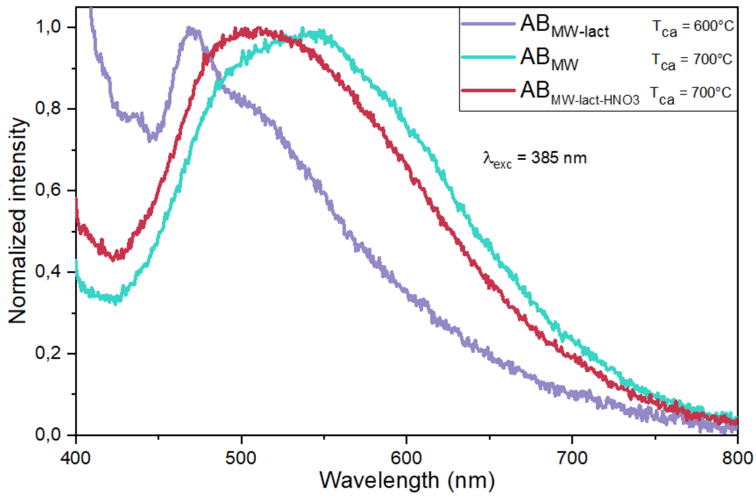


*Figure S12: Normalized room-temperature emission spectra of $AB_{MW}$ powders synthesised using different conditions (with or without nitrates and calcined at 600°C or 700°C) recorded under 385 nm excitation*

*Table S2: $AB_{MW}$ and $AB_{MW\_lact+HNO_3}$ precursors ratios.*

| Sample | $NO_3$/Al | $Al(NO_3)_3 \cdot 9H_2O$ | : | $Al(C_3H_5O_3)_3$ | : | $HNO_3$ | : | $H_3BO_3$ | : | Cit | : | Sorb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $AB_{MW}$ | 3 | 1 | : | 0 | : | 0 | : | 2 | : | 9,75 | : | 9,75 |
| $AB_{MW\_lactate+HNO_3}$ | 3 | 0 | : | 1 | : | 3 | : | 2 | : | 9,75 | : | 9,75 |