Supporting Information

Catalyst-free Synthesis, Structural and Mechanical Characterization of Single Crystalline $Ca_2B_2O_5•H_2O$ Nanobelts and Stacking Faulted $Ca_2B_2O_5$ Nanogrooves

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Experimental

The chemical compositions and oxidation states of the $Ca_2B_2O_5•H_2O$ (CBOH) nanobelts and $Ca_2B_2O_5$ (CBO) nanogrooves were further characterized by X-ray photoelectron spectroscopy (XPS) (a Kratos Axis Ultra DLD instrument equipped with a monochromated Al K_α X-ray source and a hemispherical analyzer with an energy resolution of 0.5 eV) and Fourier transform infrared (FTIR) spectroscopy (a Perkin Elmer Spectrum 100 FTIR spectrometer with a Diamond ATR attachment).

Supplemental Figures

Supplemental Figure 1

XPS spectra of the CBOH nanobelts and CBO nanogrooves, labeled as α and β, respectively. Calibration was carried out by taking the binding energy of the C 1s core level at 284.8 eV. Both survey spectra, shown in Figure 1a, exhibit Ca 2p (346.2 eV), Ca 2s (437.6 eV), B 1s (188.2 eV), O 1s (532 eV) and C 1s (284.8 eV) core levels, and no other impurity levels were detected, further indicating the high purity of the

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products. In Figure 1b, the peaks at 346.2 eV and 349.8 eV can be assigned to Ca $2p_{3/2}$ and Ca $2p_{1/2}$, respectively. Figure 1c shows the B 1s XPS spectra, the peak at 188.3 eV can be attributed to B $1s_{1/2}$ core level. As shown in Figure 1d, there are two peaks (530.0 eV and 531.7 eV) for O 1s state in the CBOH nanobelts. This is probably due to two different oxidation states of O 1s at the molecule CBOH, one of which is for the CBO molecule, and another is for the hydrated H_2O molecule.

Supplemental Figure 2

FTIR spectra of the CBOH nanobelts and CBO nanogrooves. For the CBOH nanobelts (Figure 2a), the adsorption band at 3353 cm^{-1} can be assigned to the stretching mode of O-H. [1-2] There is no adsorption band detected at 1600-1700 cm^{-1}, which arises from the bending mode of H-O-H, and this result indicates that the compound doesn't contain crystal water. [3] The adsorption bands at 1414, 1321 and 911 cm^{-1} result from the asymmetric and symmetric stretching modes of $B_{(3)}$-O, respectively. The band at 1155 cm^{-1} is related to the in-plane bending mode of B-O-H. The weak band at 875 cm^{-1} comes from the symmetric stretching mode of $B_{(4)}$-O. [3] The very strong band at 708 cm^{-1} originates from the out-of- plane bending mode of $B_{(3)}$-O. [1, 3] As for the CBO nanogrooves (Figure 2b), there is no adsorption detected at 3000-3600 cm^{-1}, which suggests that the H_2O in CBOH has been completely removed after annealing. All other adsorption bands close to that of CBOH nanobelts have the same origins according to the previous literature. [1]

References

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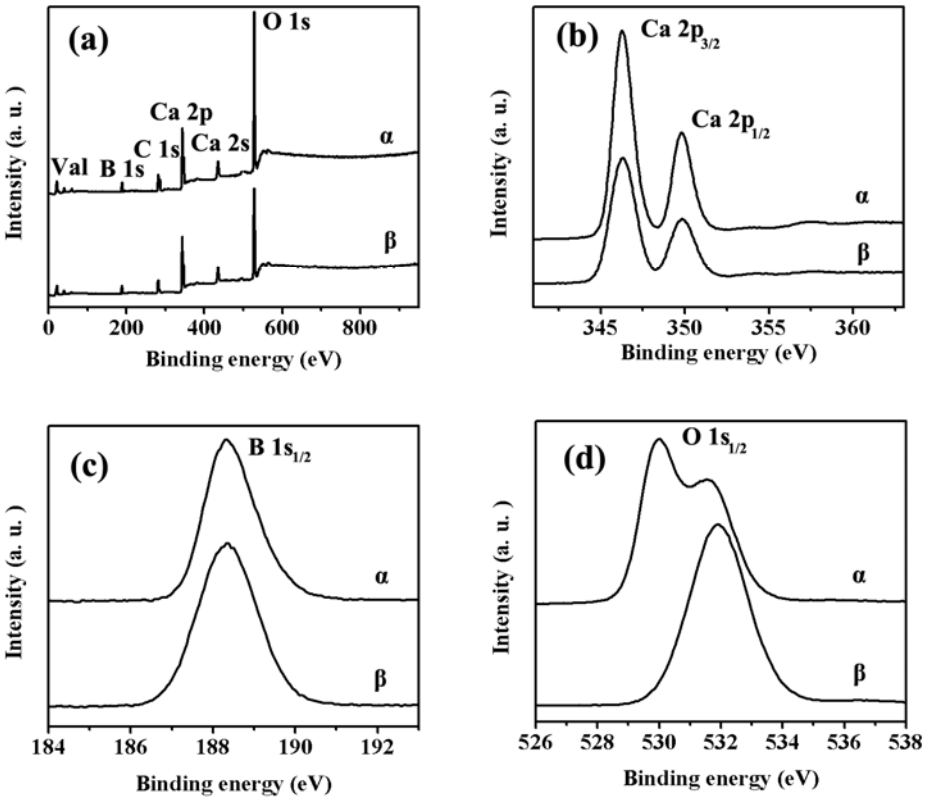

Figure 1

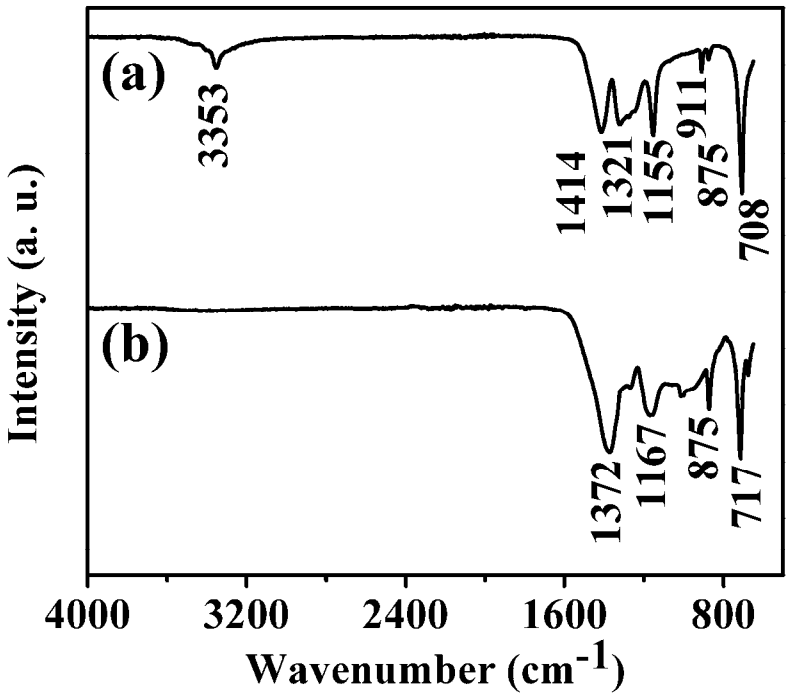
(a)
3353
1414
1321
1155
911
875
708
(b)
1372
1167
875
717
Intensity (a. u.)
4000
3200
2400
1600
800
Wavenumber (cm-1)

Figure 2