Supplementary Information

TEM observation and EDX and EELS analysis of MBH-CA and MBH-KS6.

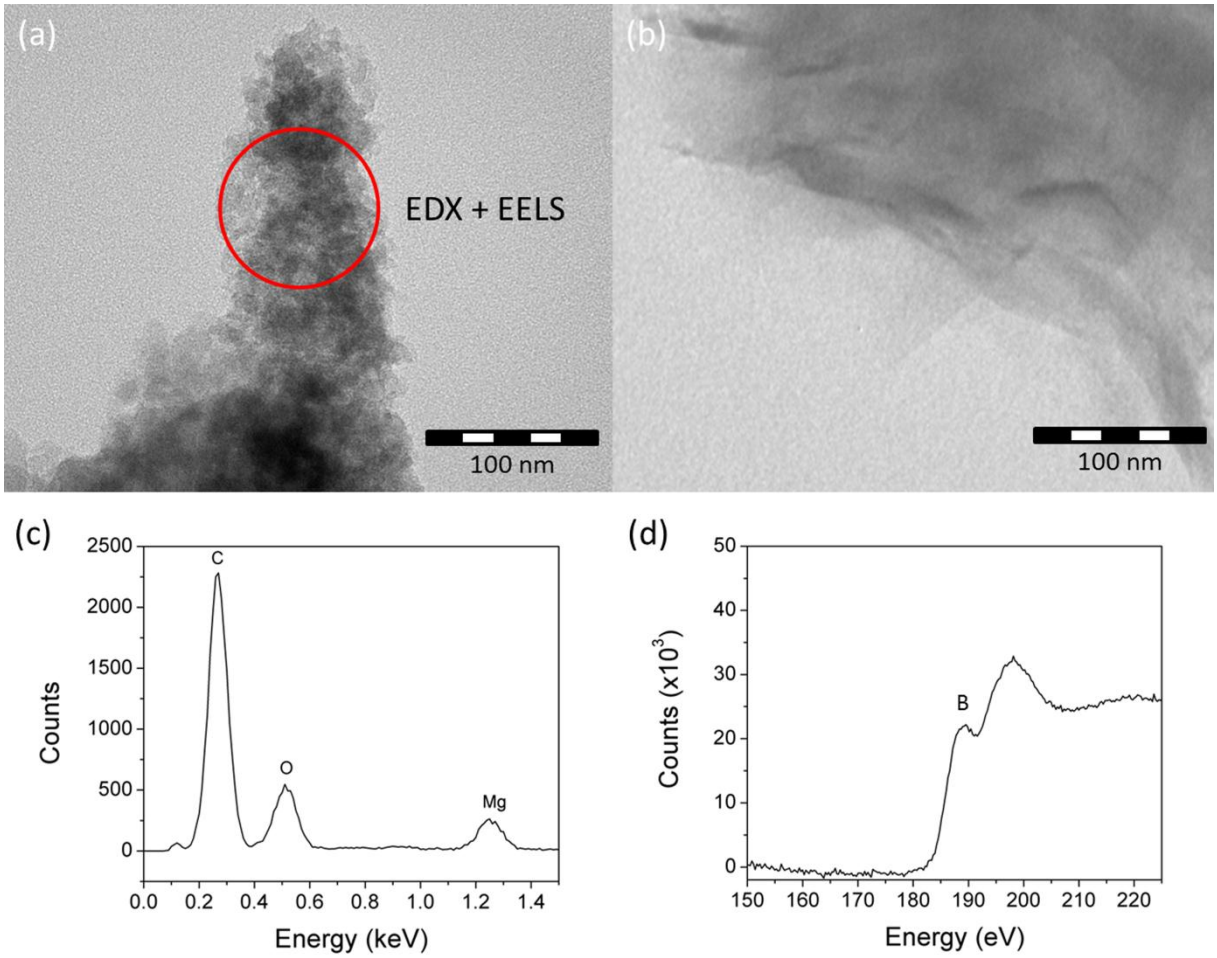

Fig. S1 Bright field TEM image of (a) MBH-CA and (b) MBH-KS6, (c) EDX and (d) EELS spectra of (a). The red circle in (a) shows the area for EDX and EELS measurements of MBH-CA.

The images show mainly the structure of the carbon supports after ball milling. MBH-CA displays the agglomerates of small particles with sizes of 20 to 30 nm. MBH-KS6 shows the plates from the layered structure of graphite in KS6 in (b). The EDX spectrum shows the presence of Mg and C and EELS spectrum displays the presence of boron signal.

Thermogravimetry (TG) measurement results of MBH-CA, MBH-KS6 and bulk $Mg(BH_4)_2$.

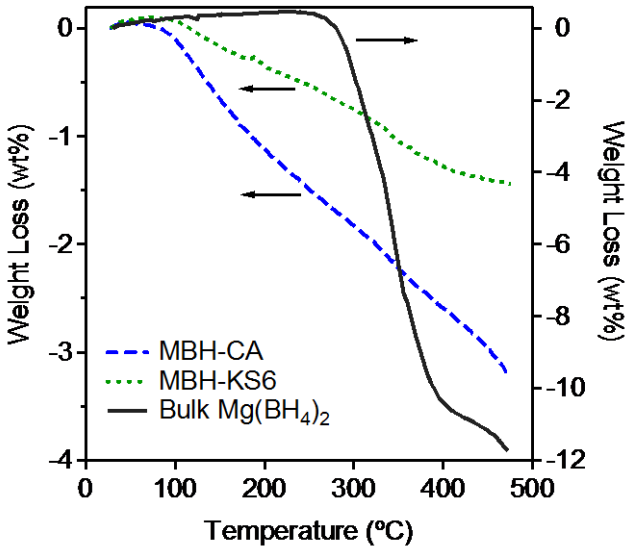

Fig. S2 TG curves of MBH-CA, MBH-KS6 and bulk $Mg(BH_4)_2$ reference, respectively. Constant Ar flow of 200 ml/min, heating rate of 5 ºC/min.

The desorption performance of MBH-CA and MBH-KS6, as compared to bulk $Mg(BH_4)_2$ reference, were examined by TG. The bulk $Mg(BH_4)_2$ reference starts to decompose above 250 ºC with a weight loss of about 12 wt% up to 470 ºC. MBH-CA shows an initial decomposition temperature around 100 ºC and a weight loss of 3.2 wt% up to 470 ºC. Weight loss of MBH-KS6 also starts around 100 ºC and is summed up to 1.4 wt%.

Cycling property of MBH-CA

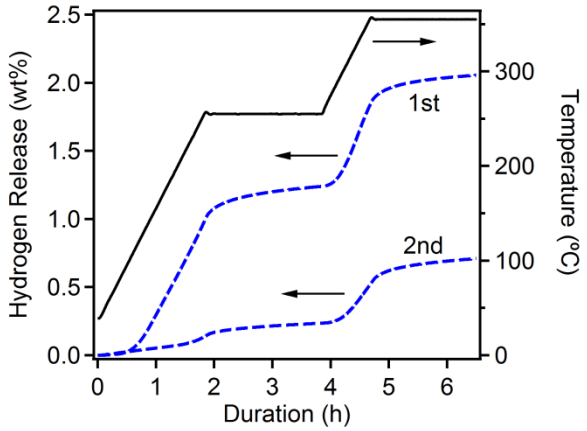

Fig. S3 The hydrogen desorption of MBH-CA in the two cycles. Rehydrogenation reaction was carried out at 270 ºC and 150 bar H_2 for 20 h. Appropriately 30 % of hydrogen is reversibly stored in the 2nd cycle.

TEM observation and EDX and EELS analysis of MBH-CA after rehydrogenation

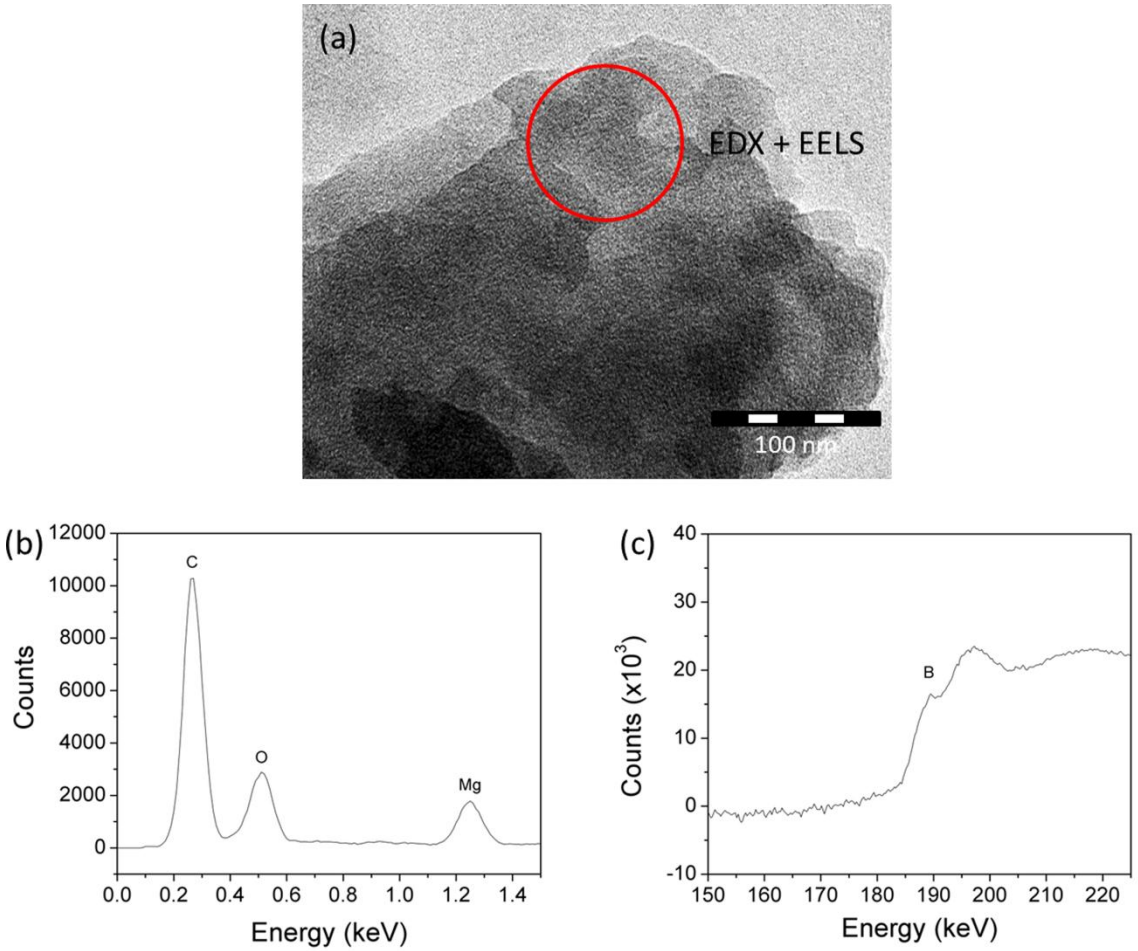

Fig. S4 (a) TEM-bright field image of MBH-CA after rehydrogenation at 270 ^{0}C, 150 bar H_2. (b) EDX analysis of designated area in (a). (c) EELS measurement on marked area in (a).