Supporting Information

Improving Alkene Selectivity of Nanocarbon Catalyzed Oxidative Dehydrogenation of *n*-Butane by Refinement of Oxygen Species

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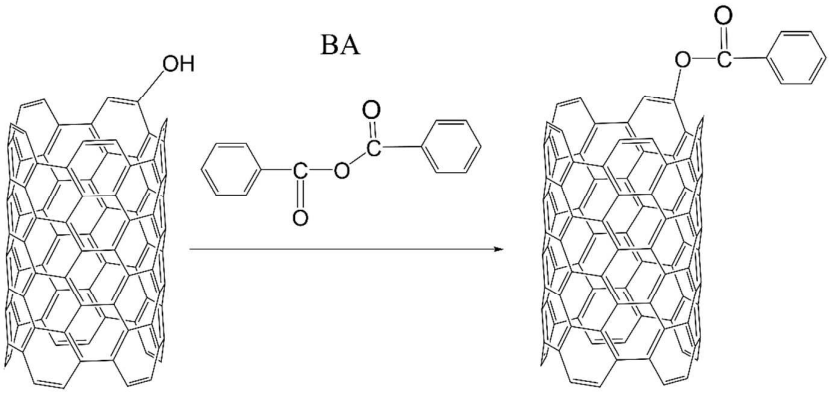
Table S1. O/C weight content ratio of o-CNT, oCNT-$LiAlH_4$ and o-CNT under different annealing temperatures before and after ODH of butane.

Samples	O/C weight ratio	
	Before ODH	After ODH
o-CNT	0.169	0.036
oCNT-$LiAlH_4$	0.060	0.054
oCNT-500	0.034	0.031
oCNT-700	0.009	0.032
oCNT-900	0.004	0.017
oCNT-1100	0.003	0.020



Scheme S1. Selective deactivation of phenol groups on CNTs by benzoic anhydride (BA).

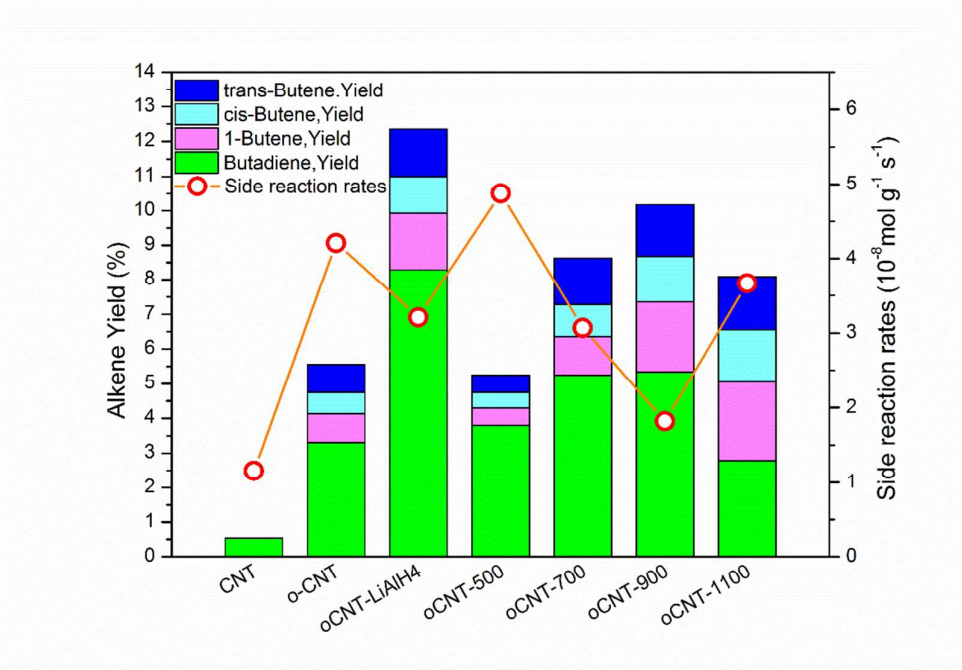
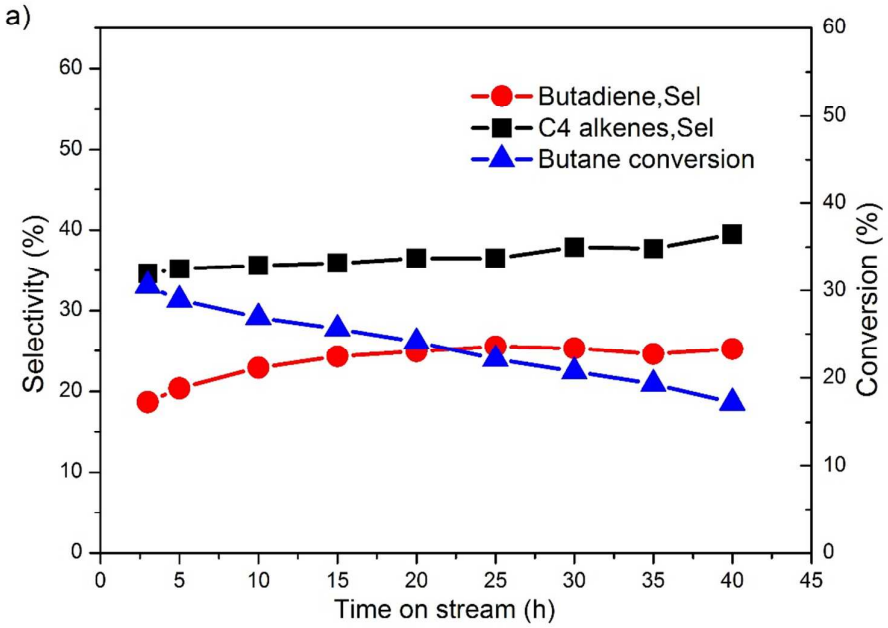


Figure S1. C_4 alkene yield and side-reaction rates of pristine CNTs, o-CNT, oCNT-$LiAlH_4$, oCNT-500, oCNT-700, oCNT-900 and oCNT-1100. The ODH reaction conditions: 723 K, 1 atm, O_2/butane=2.



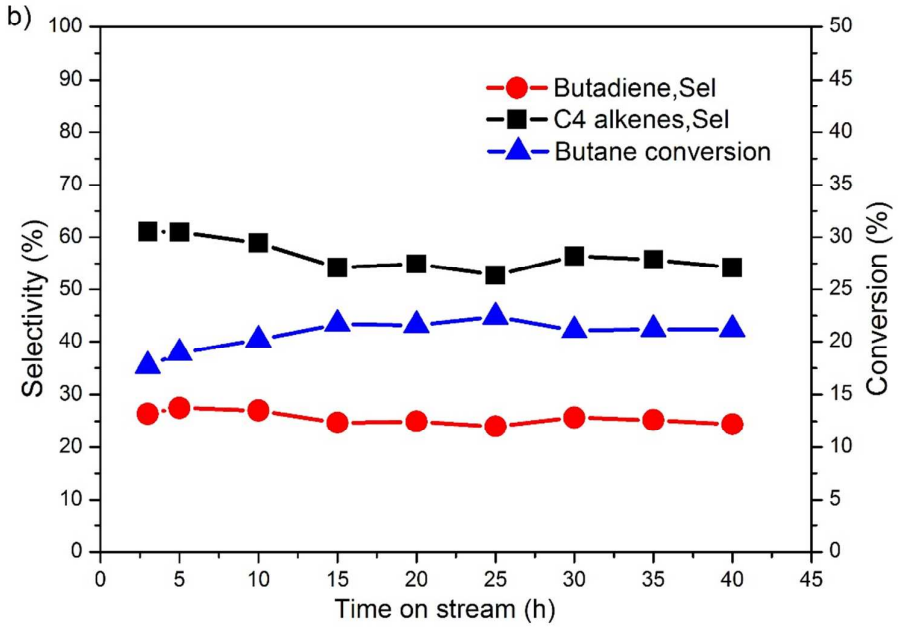


Figure S2. Stability of a) oCNT-$LiAlH_4$ and b) oCNT-900 for ODH of butane over 40 hours. There is 55 % catalyst weight loss of catalyst of oCNT-$LiAlH_4$ after 40 hours while the catalytic performance of oCNT-900 is highly stable. The ODH reaction conditions: 723 K, 1 atm, O_2/butane=2.

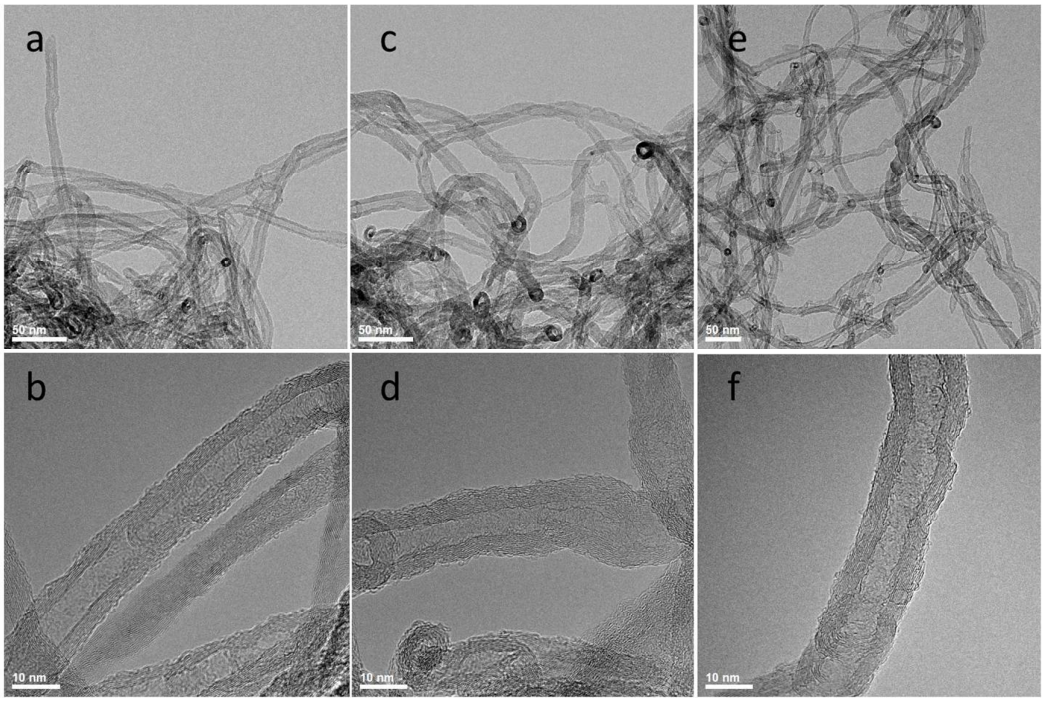


Figure S3. TEM images of o-CNT (a, b), oCNT-$LiAlH_4$ (c, d) and oCNT-900 (e, f).

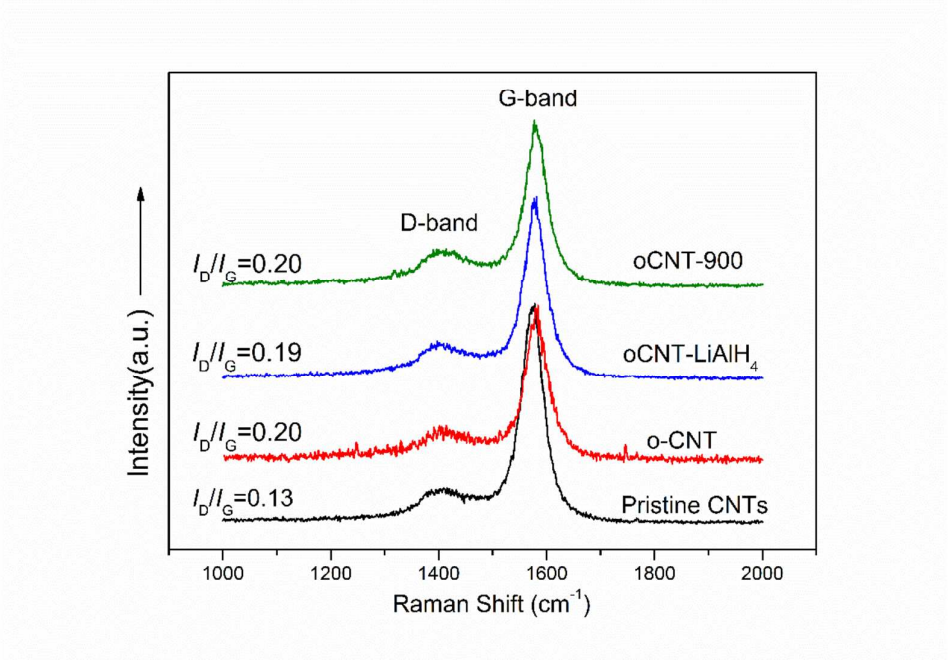


Figure S4. Raman spectra of pristine CNTs, o-CNT, oCNT-LiAlH$_4$ and oCNT-900.

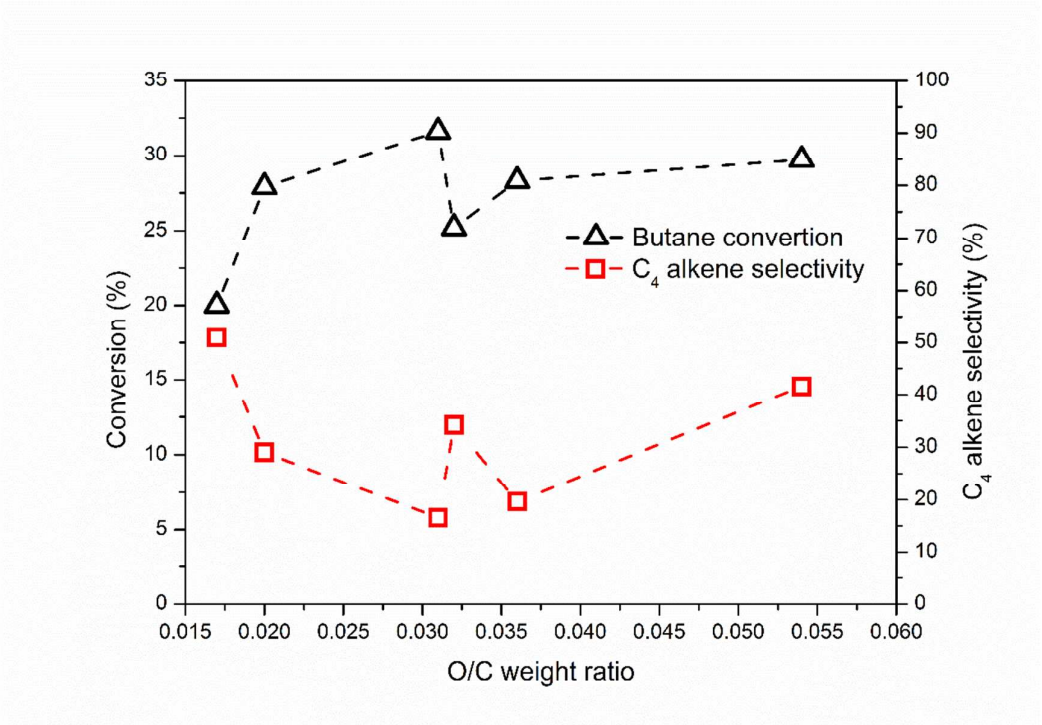


Figure S5. Catalytic performance of CNTs catalysts with different O/C weight content ratio. The samples involved: o-CNT, oCNT-LiAlH$_4$, oCNT-500, oCNT-700, oCNT-900 and oCNT-1100.

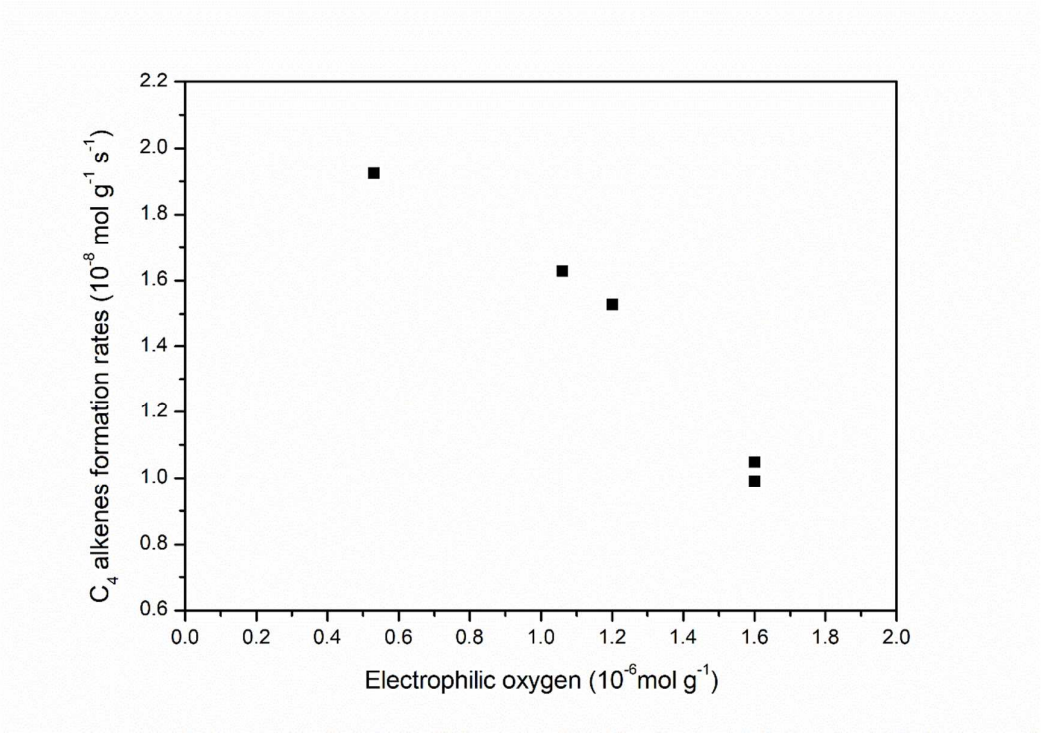


Figure S6. C_4 alkenes formation rates on CNTs samples with different amount of electrophilic oxygen after ODH of *n*-butane (the samples include o-CNT, oCNT-500, oCNT-700, oCNT-900 and oCNT-1100). The ODH reaction conditions: 723 K, 1 atm, O_2/butane=2.

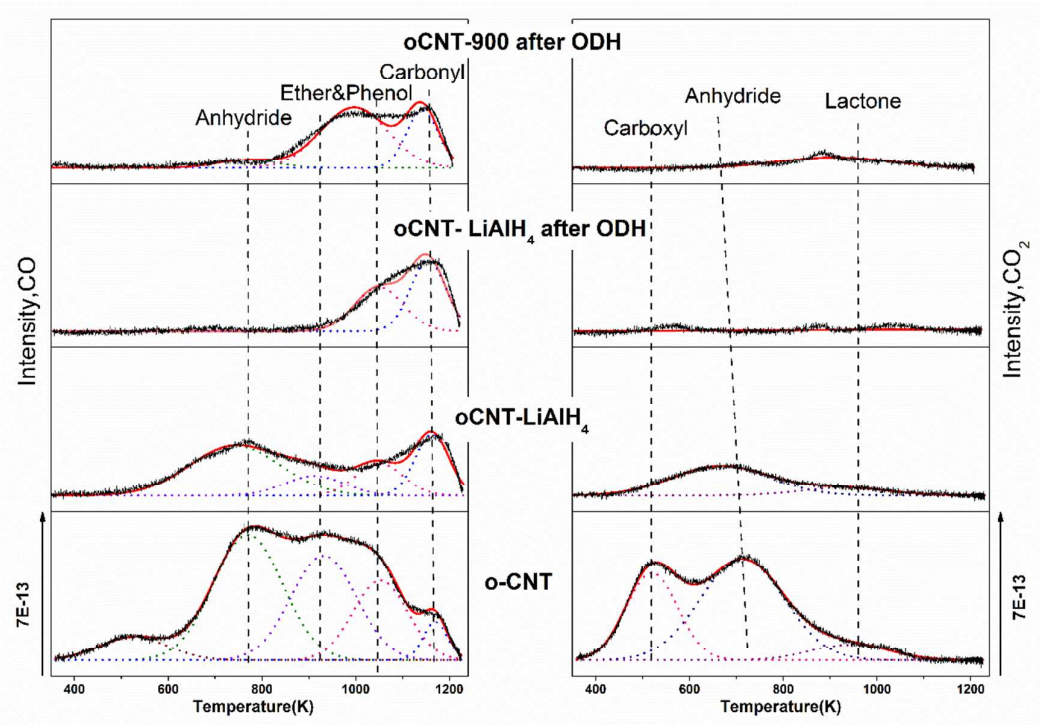
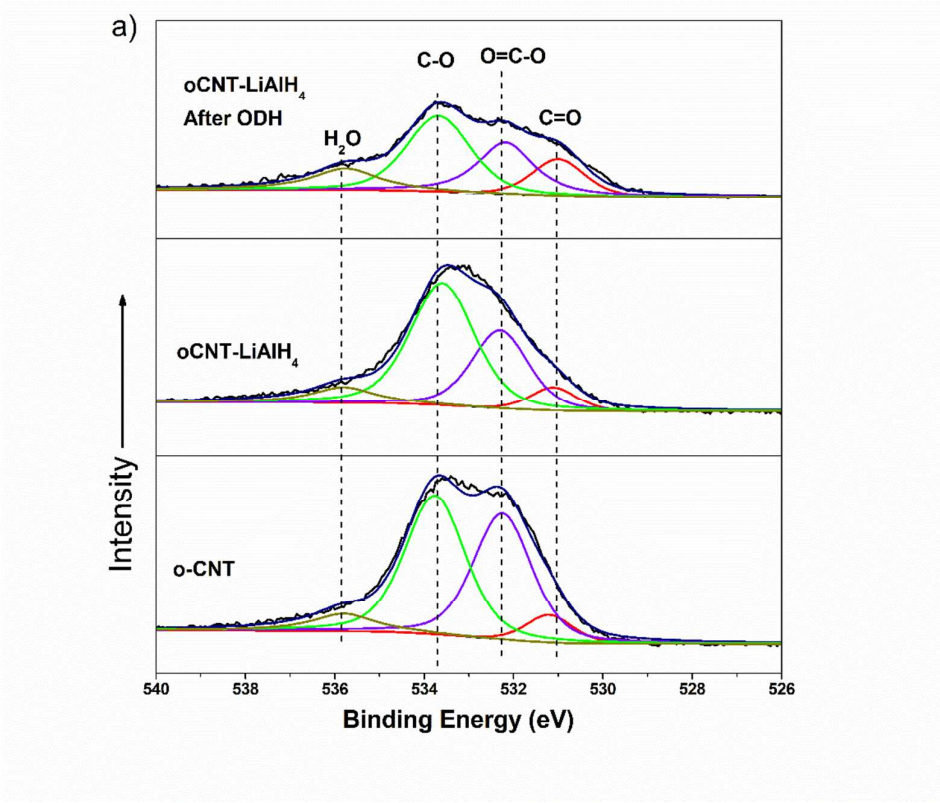


Figure S7. Deconvolution of TPD profiles for CO (left) and CO_2 (right) desorption of the following samples: o-CNT, oCNT-$LiAlH_4$, oCNT-$LiAlH_4$ and oCNT-900 after ODH of butane.



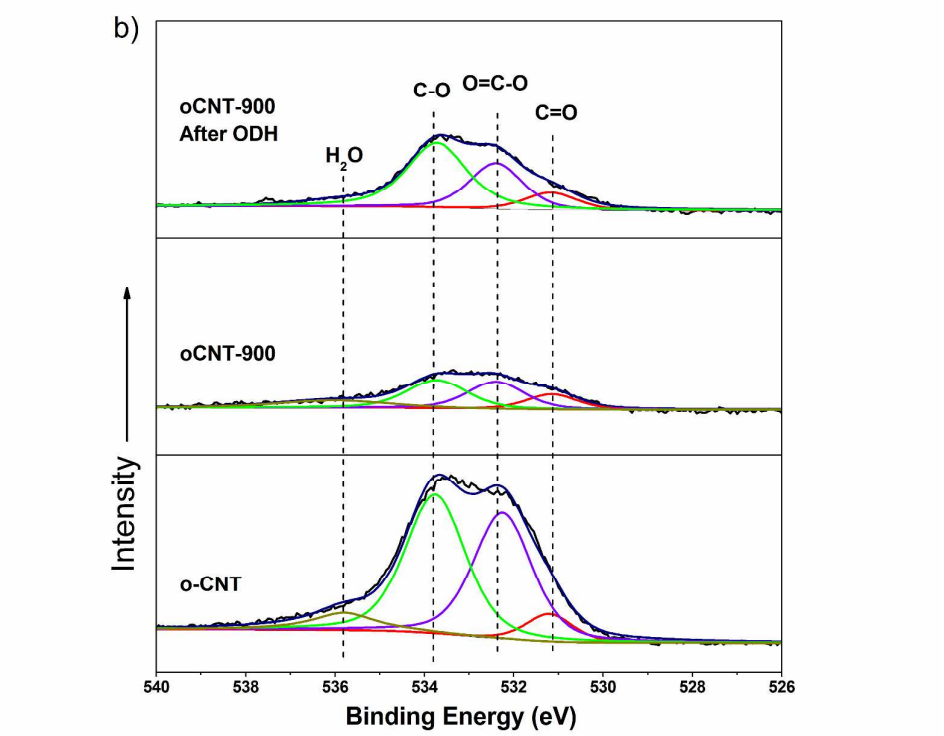


Figure S8. Deconvolution of O1s XPS spectra of a) o-CNT and oCNT-$LiAlH_4$ before and after ODH b) o-CNT and oCNT-900 before and after ODH.

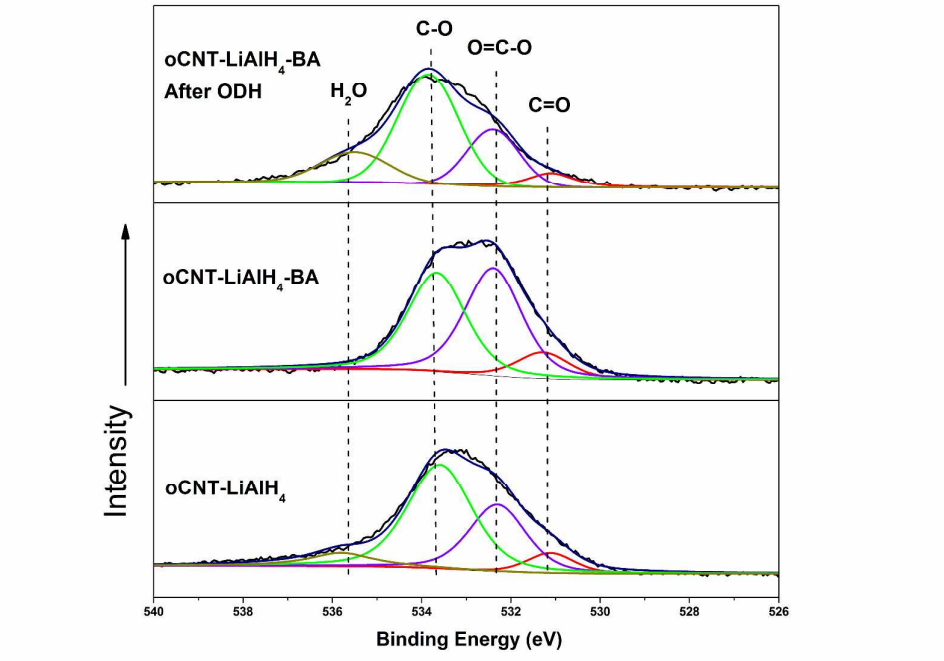


Figure S9. Deconvolution of O1s XPS spectra of oCNT-$LiAlH_4$ and oCNT-$LiAlH_4$-BA.

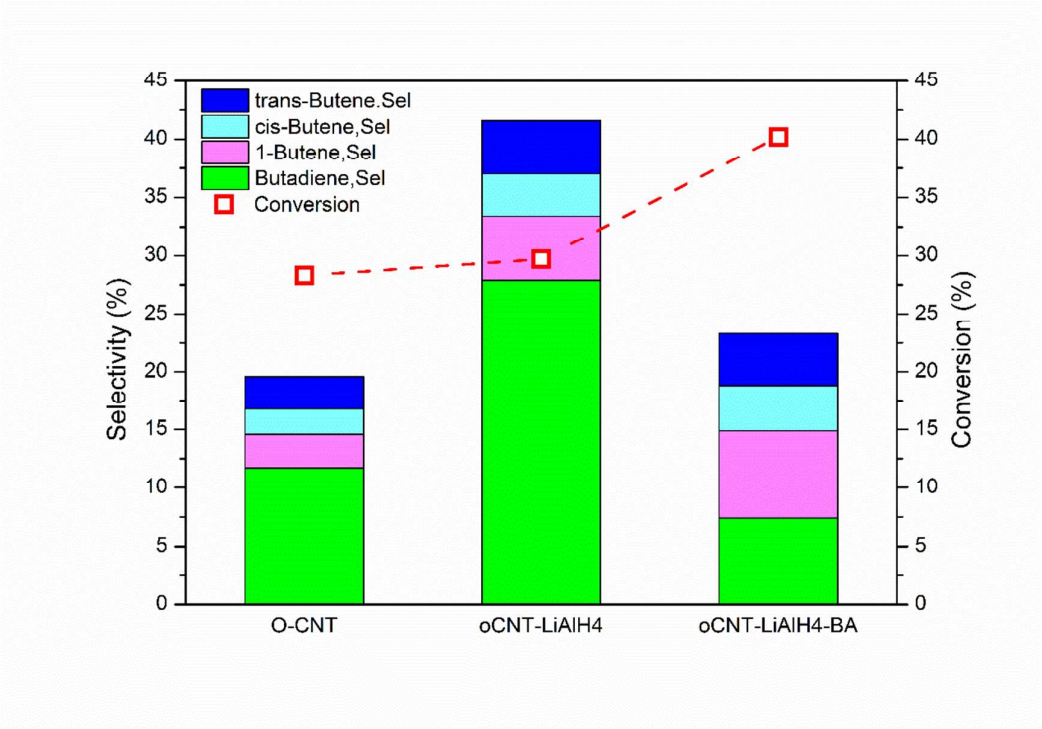


Figure S10. ODH activities of o-CNT, oCNT-$LiAlH_4$ and oCNT-$LiAlH_4$-BA.