

Supplementary Information

FTO-free counter electrodes for dye-sensitized solar cells using carbon nanosheets from a polymeric carbon source

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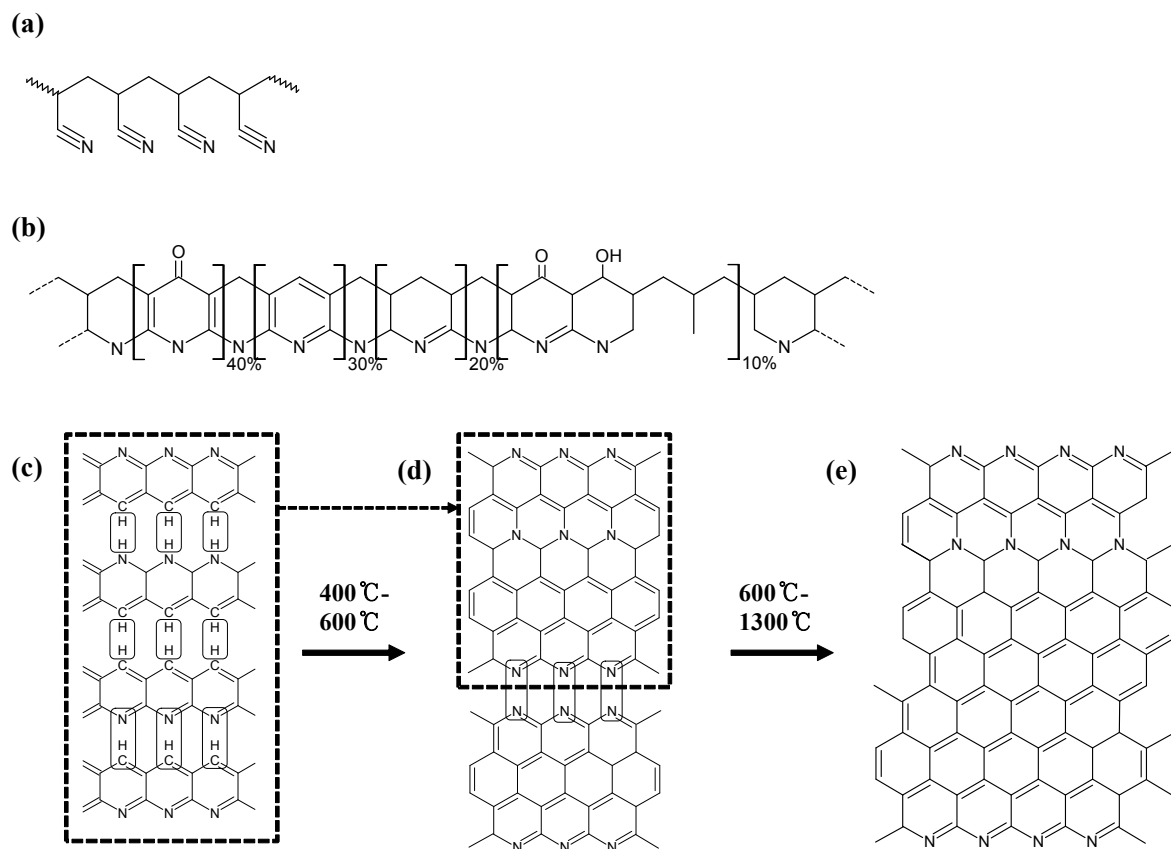


Fig. S1. The reaction mechanism of the preparation of CNS-CE using PAN as the precursor; (a) structure of PAN, (b) the structure of oxidized PAN, (c-e) the reaction during carbonization [1].

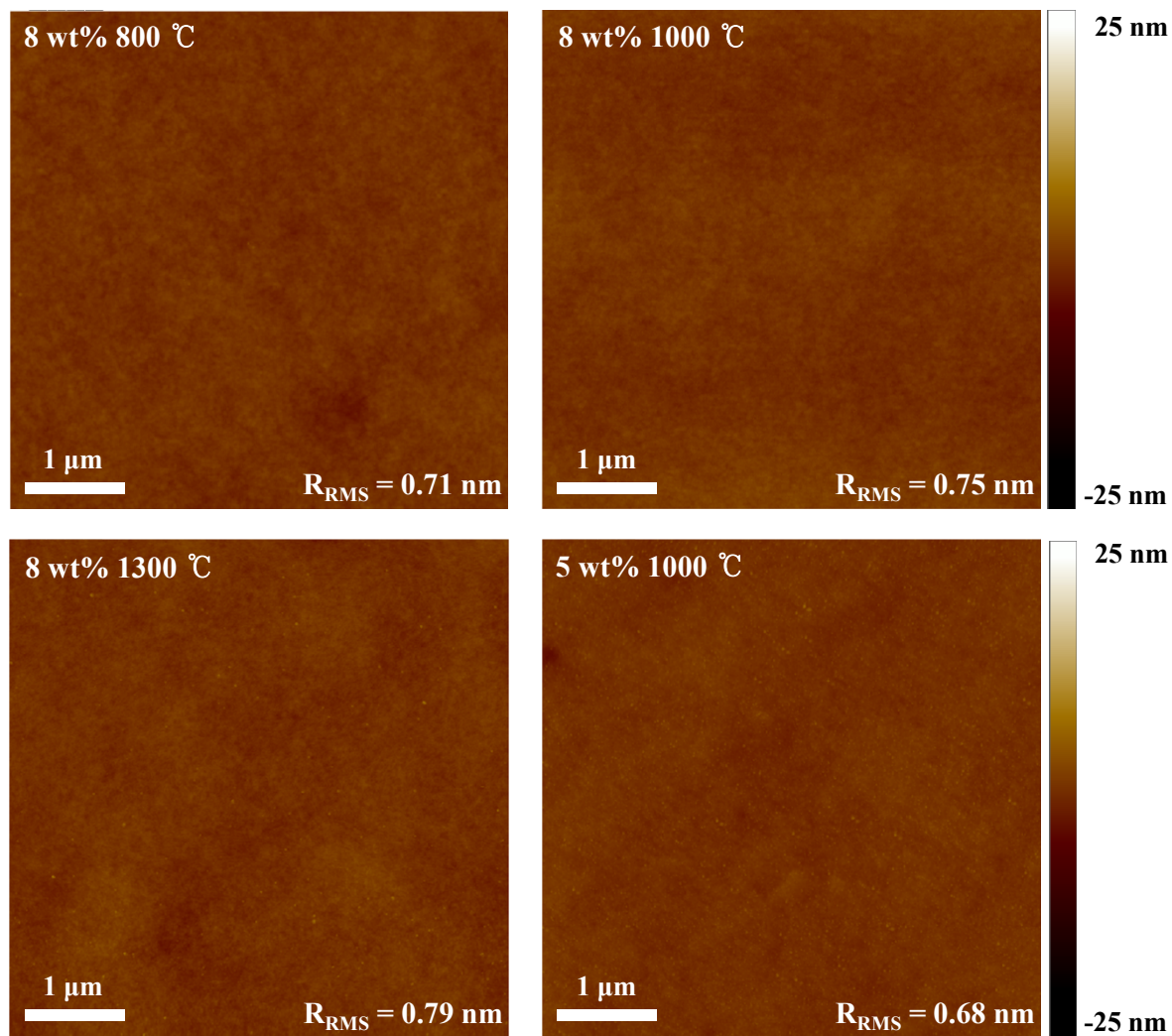


Fig. S2. AFM images of CNS-CEs carbonized at various conditions. All the samples showed similar root mean square roughness.

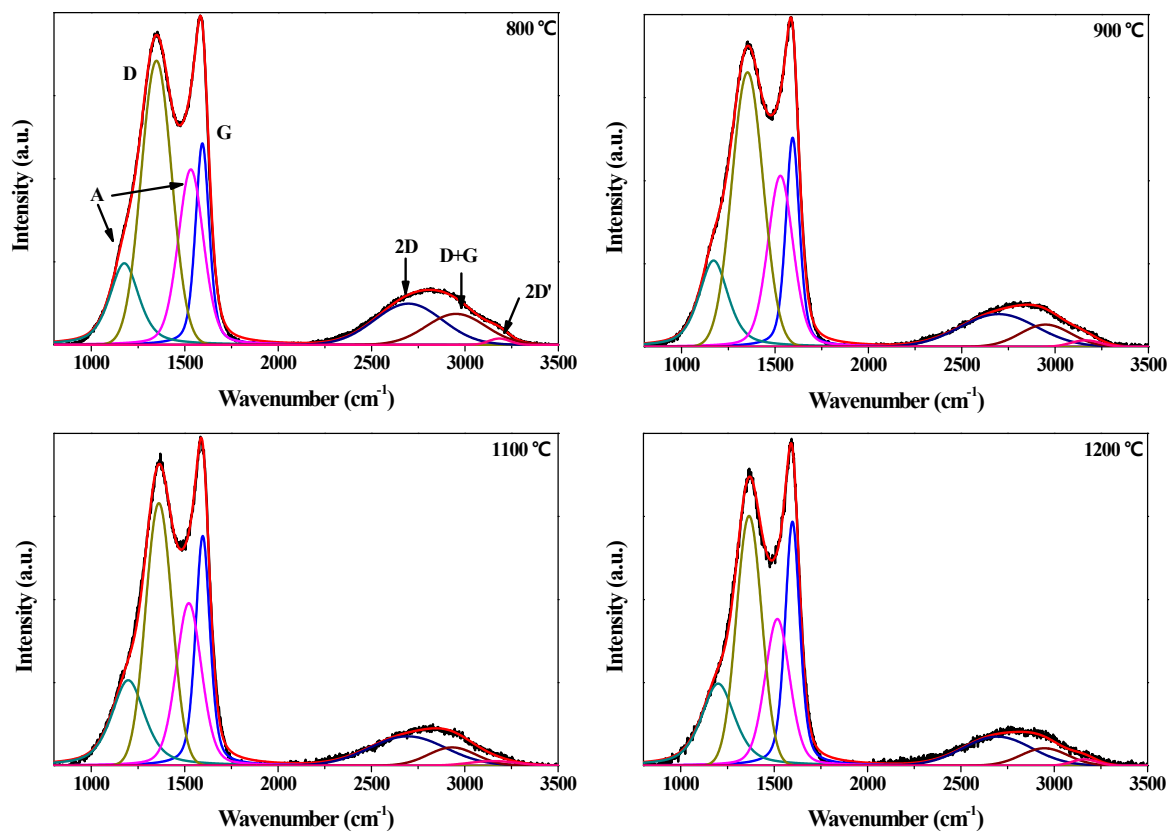


Fig. S3. Deconvoluted version Raman spectra of CNSs prepared at a range of carbonization temperatures.

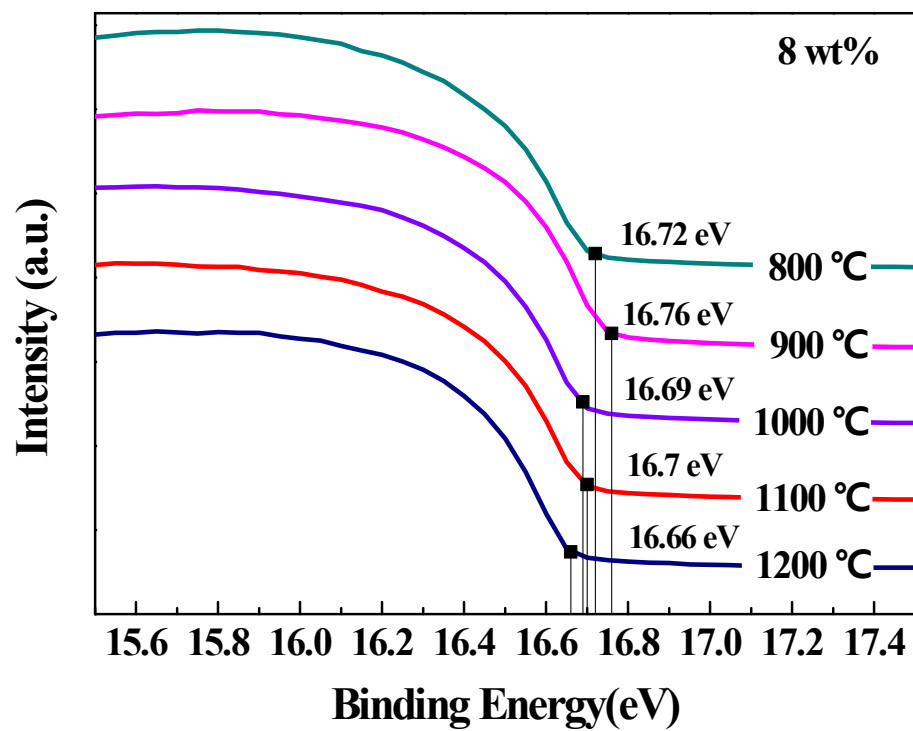


Fig.e S4. The UPS analysis results of CNS-CEs prepared at various carbonization temperatures.

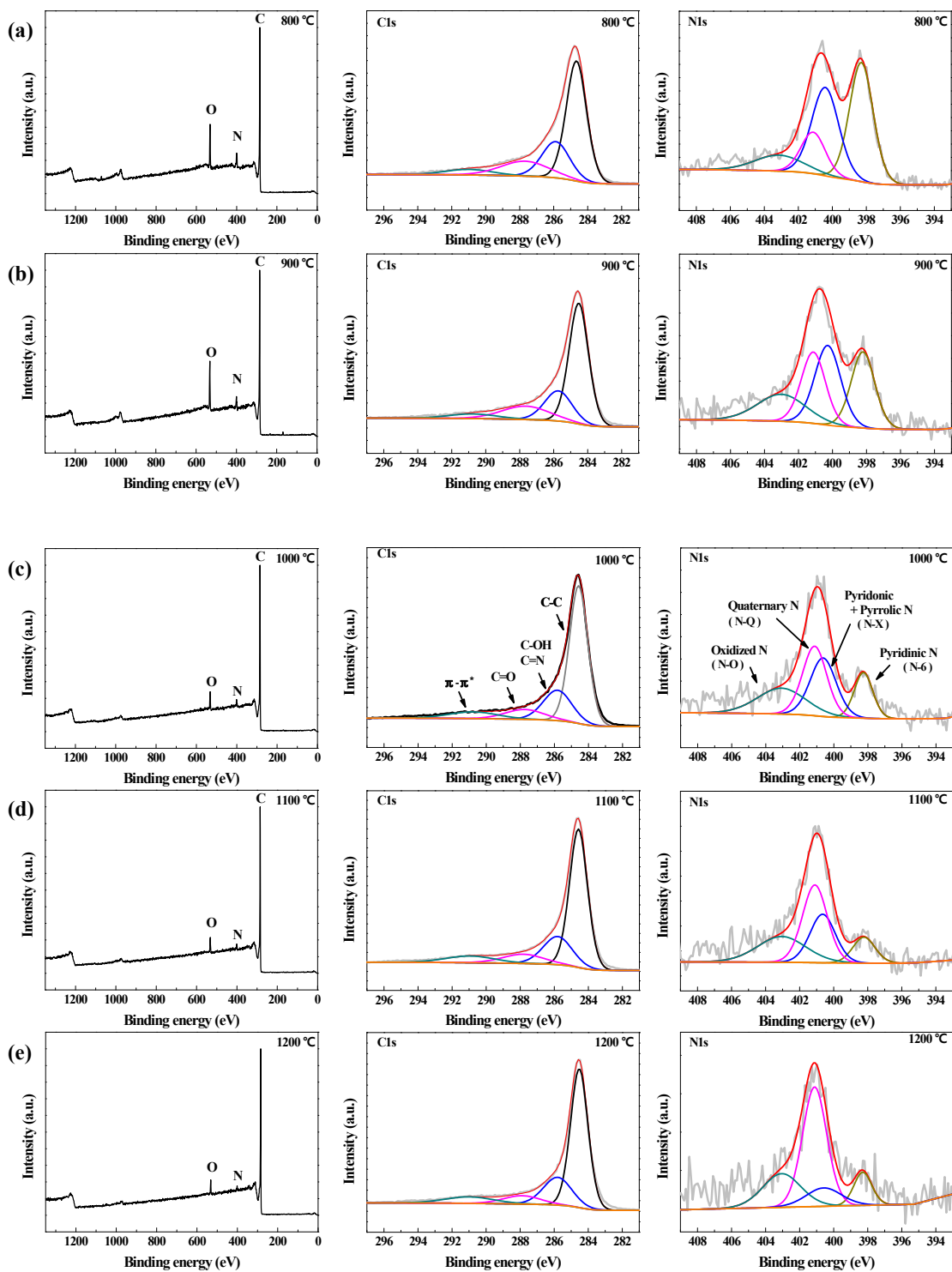


Fig. S5. The XPS spectra of various CNSs; (a) 800 °C, (b) 900 °C, (c) 1000 °C, (d) 1100 °C, (e) 1200 °C. The detailed indications for the deconvoluted peaks are shown in (c).

Table S1. Atomic composition of various CNSs obtained from XPS spectra.

CNS sample	C (atomic%)	O (atomic%)	N (atomic%)
CNS-800	81.81	11.17	7.01
CNS-900	85.66	9.53	4.81
CNS-1000	91.57	4.89	3.53
CNS-1100	93.08	3.88	3.04
CNS-1200	94.46	3.35	2.19

Reference

- [1] M. Rahaman, A.F. Ismail, A. Mustafa, A review of heat treatment on polyacrylonitrile fiber, *Polym. Degrad. Stab.* 92 (2007) 1421-1432.