

Supporting information

Preparation of large-area ultrathin carbon semiconductor

converted from conjugated microporous polymer film

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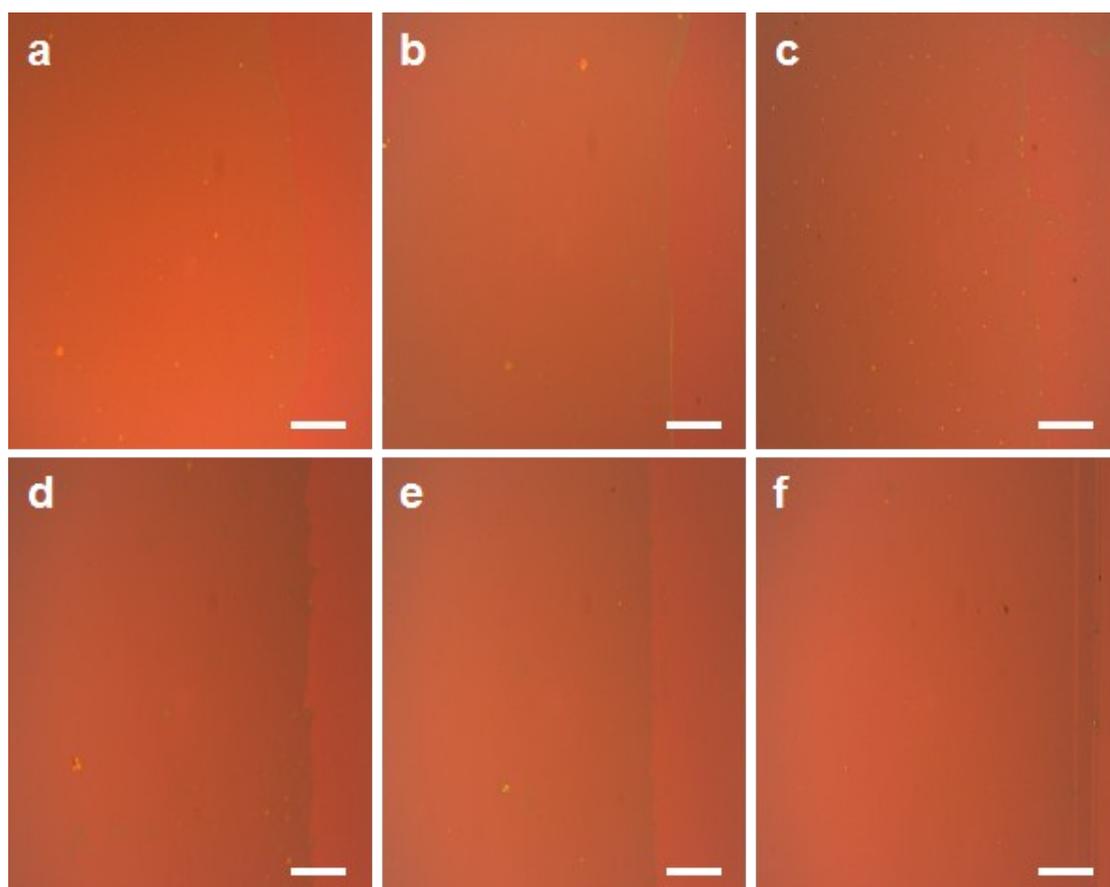


Fig. S1 Optical images of CMP and CNF grown on SiO₂/Si substrates under different annealing temperature (a) 25 °C, (b) 400 °C, (c) 600 °C, (d) 700 °C, (e) 750 °C and (f) 800 °C, respectively. Scale bar, 20 μm.

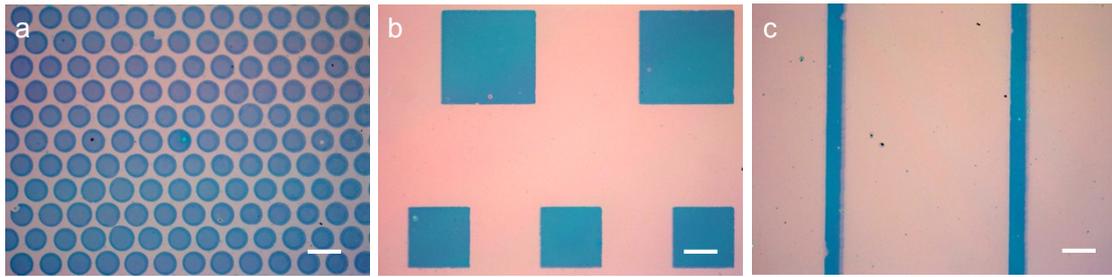


Fig. S2 Optical micrographs of patterned CNFs on SiO₂/Si substrates, including (a) circular, (b) square, and (c) oblong geometries were prepared by annealing patterned CMP nanofilms. Scale bars: 100 μ m.

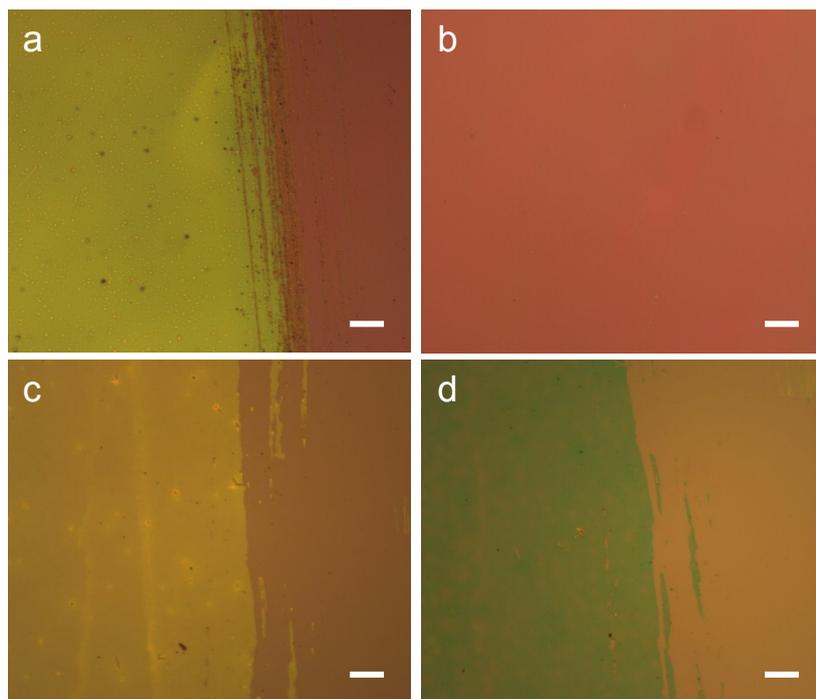


Fig. S3 Optical micrographs of monomers and polymer before and after 800 °C annealing. the spin-coated monomer film on a SiO₂/Si substrate before (a) and after (b) annealing; the polymer film on a SiO₂/Si substrate before (c) and after (d) annealing. Scale bar, 40 μm.

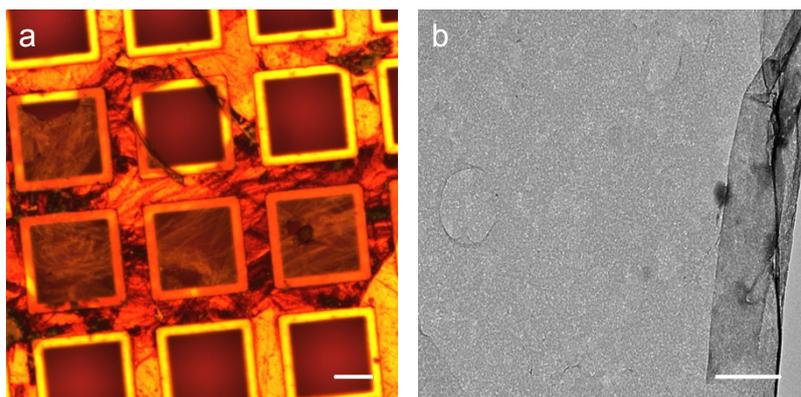


Fig. S4 (a) Optical micrograph of CNF-800. Scale bar, 10 μm . (b) TEM of CNF-800. Scale bar, 1 μm .

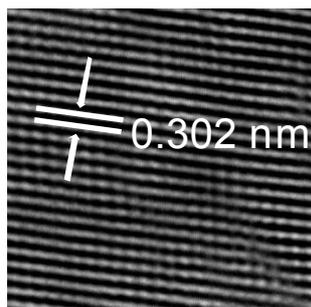


Fig. S5 HRTEM of CDs.

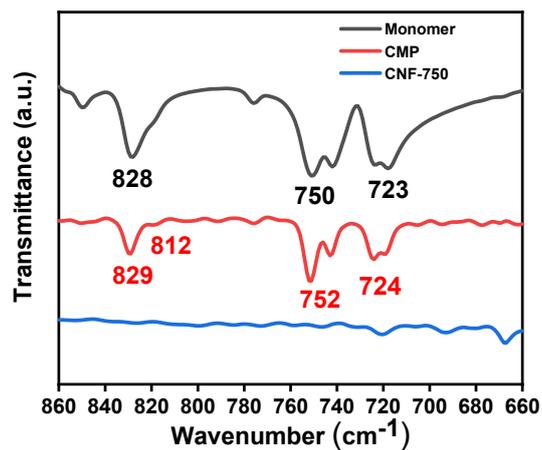


Fig. S6 FTIR spectra of monomer, CMP and CNF-750. The peaks at 723/750 cm⁻¹ and 724/752 cm⁻¹ in monomer and CMP samples can be designated to the vibrational bands of C–H bonds of ortho-bisubstituted carbazole ring. The FTIR peaks at 828 cm⁻¹ in monomer sample and 829 cm⁻¹ in CMP are attributed to the para-disubstituted phenyl ring.

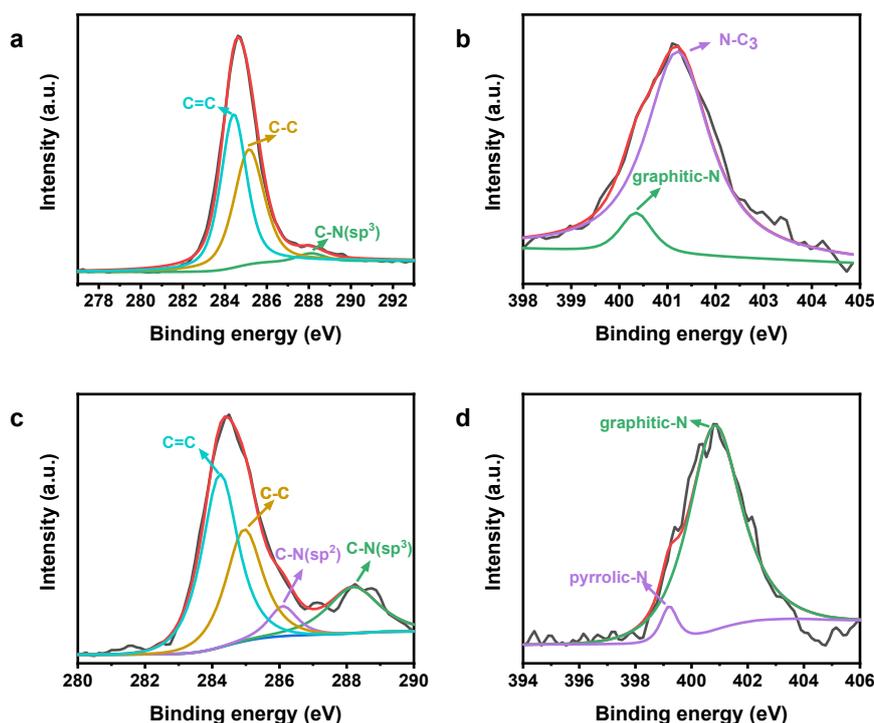


Fig. S7 a) C 1s and b) N 1s of the CMP, c) C 1s and d) N 1s of the CNF-750. The deconvolution of C 1s signal reveals three components centered at 284.5, 285.0 and 288.2 eV (Fig. S7a), which corresponds to C=C, C-C, and C-N (sp^3), respectively. After annealing at 750 °C, the peak at 284.5 eV corresponds to the graphite-like sp^2 carbon (Fig. S7c), indicating most of carbon atoms are arranged in a conjugated honeycomb lattice.¹ The high content of graphitic-like sp^2 carbon has contributed to the increase of electrical conductivity. The small peaks at 285.0, 286.1 and 288.5 eV are attributed to C-C, C-N (sp^2) and C-N (sp^3) (Fig. S7c), respectively. There are two peaks at 400.4 eV and 401.2 eV, which represent graphitic-N and quaternary N (Fig. S7b), respectively. As shown in Fig. S7d, the major part of nitrogen is allocated between pyrrolic-N (at 399.2 eV) and graphitic-N (at 400.8 eV).²

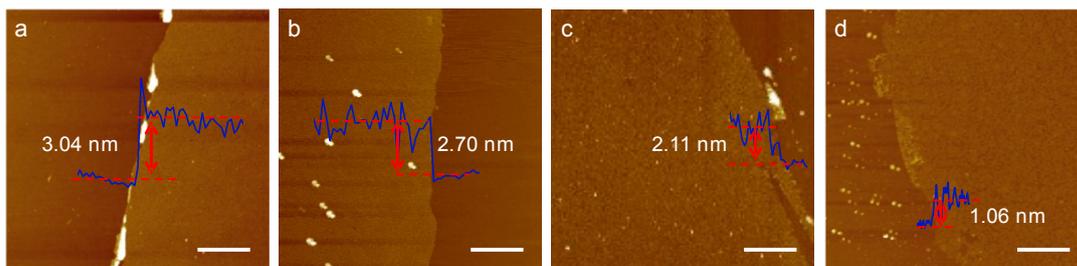


Fig. S8 AFM images of CNF grown on SiO₂/Si substrates under different annealing temperature. (a) 400 °C, (b) 600 °C, (c) 700 °C and (d) 800 °C, respectively. Scale bar, 1 μm.

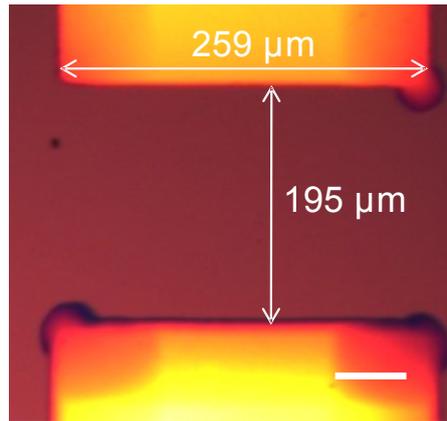


Fig. S9 Optical micrograph of the FET device. Scale bar, 50 μm.

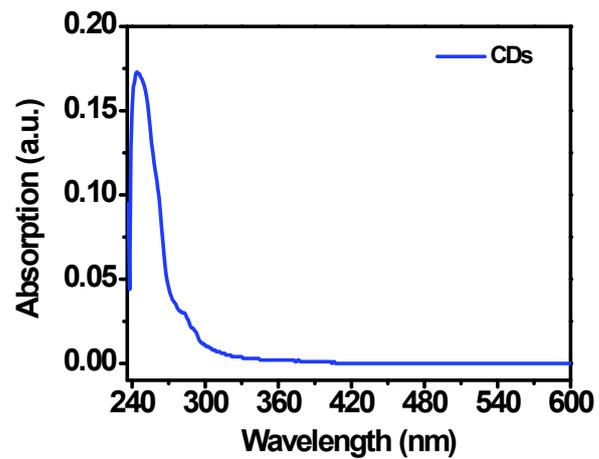


Fig. S10 Normalized UV-vis absorption spectra of CDs.

Notes and references

1. R. Li, K. Parvez, F. Hinkel, X. I. Feng, M. Klaus, *Angew. Chem.Int. Edit.*, 2013, **52**, 5535-5538.
2. T. Yuan, Y. S. He, W. Zhang, Z. F. Ma, *Chem. Commun.*, 2016, **52**, 112-115.