Electronic Supplementary Material (ESI)

Hyperbranched polysiloxane containing carbon dots with near white light emission

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Contents

1. FTIR spectra of TEOS, TMP, NMDEA and HBPSi

The FTIR spectra of all the raw materials and HBPSi are plotted in Fig. S1. Fig. S1 shows the spectra of NMDEA (a), TMP (b), TEOS (c) and HBPSi (d), respectively. In Fig. S1a, the significant absorption peak centered at around 3381 cm^{-1} for –OH can be observed. Fig. S1b shows the characteristic peak relative to –OH at 3371 cm^{-1}. From Fig. S1c, we can see that the distinct absorption peaks at 1107 and 1084 cm^{-1} should be ascribed to Si–O–C bond. Particularly, the typical peak for –OH of the polymer HBPSi in Fig. S1d is centered at around 3379 cm^{-1}.

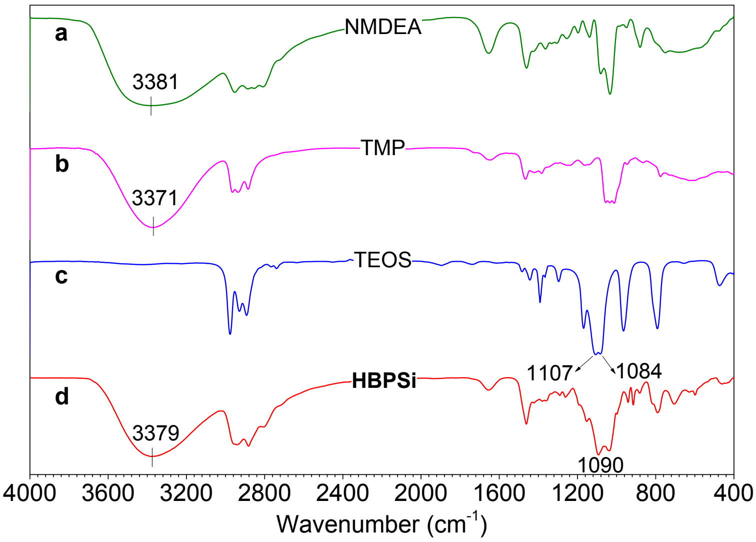

Figure S1. FTIR spectra of a) NMDEA, b) TMP, c) TEOS and d) HBPSi.

2. The fluorescence spectra of HBPSi in water-acetone mixtures

Furthermore, to get more insight into the fluorescence property of HBPSi, the emission spectra of HBPSi in the water-acetone mixture were recorded. Acetone is chosen as it is a poor solvent for HBPSi, whereas water is a good solvent. In Fig. S2, the fluorescence intensities of HBPSi increase as the fraction of acetone (f_{ace}) increases. With increasing face, these polymers are less soluble in the water-acetone systems, and the polymer chains gradually entangle and aggregate, resulting in enhanced emission. Thus, HBPSi exhibits aggregation-induced emission (AIE) characteristic.

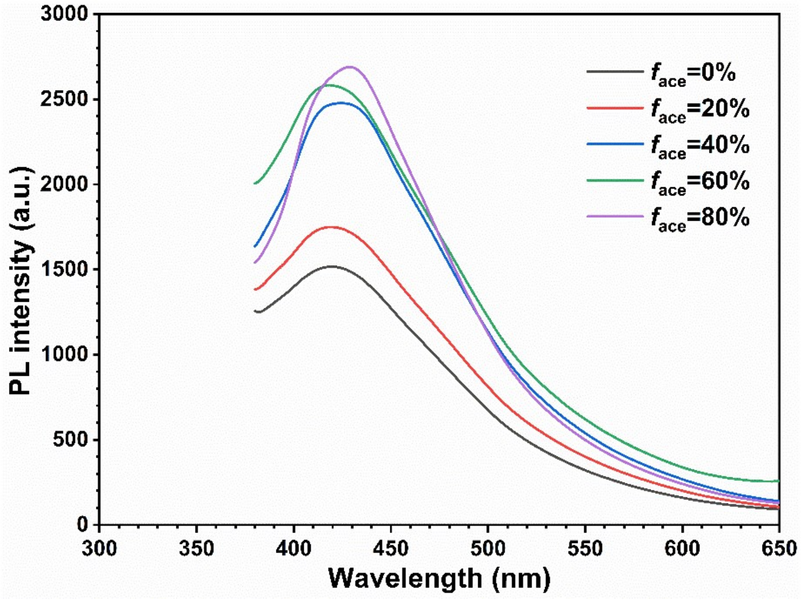

Figure S2. The fluorescence spectra (λ_{ex} = 340 nm) of HBPSi in water-acetone mixtures at a concentration of 50 mg/mL by changing acetone fraction from 0% to 80%

3. The molecular weight distribution and aggregation of HBPSi

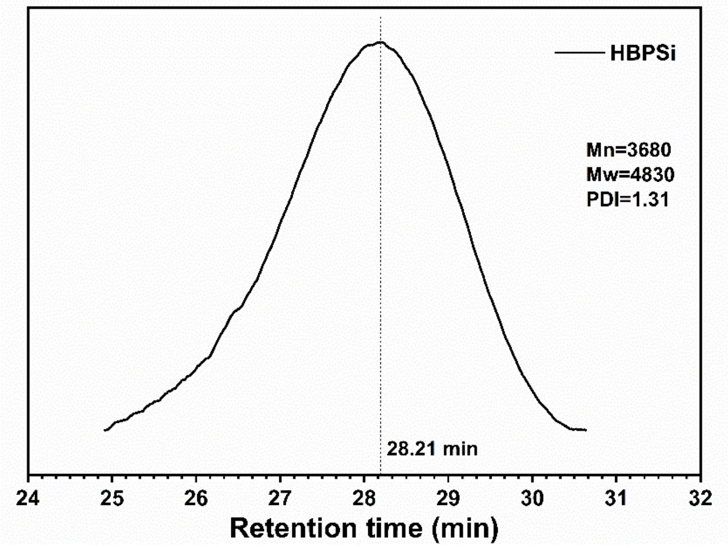

Figure S3. The molecular weight distribution of HBPSi determined by GPC (THF was used as eluent, and the measurement was performed at a flow rate of 1 mL min^{-1})

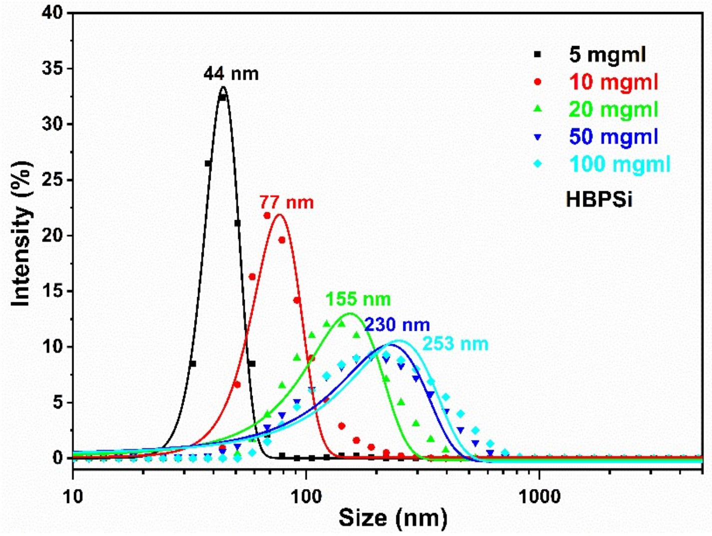

Figure S4. The aggregation sizes of HBPSi with various concentrations in aqueous solutions determined by DLS

4. FTIR spectrum of HBPSi-CDs-200

The FTIR characterization was conducted to examine the chemical structure of HBPSi-CDs-200, and it found that the HBPSi-CDs-200 shows O-H stretching vibrations at 3372 cm^{-1}, which possesses a similar peak shape to HBPSi (Fig. S5)

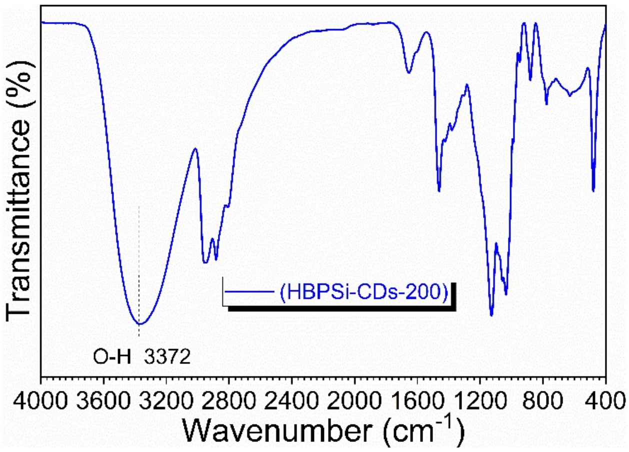

Figure S5. FTIR spectrum of HBPSi-CDs-200.

5. Characterization of HBPSi-CDs prepared at different temperatures

The ^{1}H NMR and ^{13}C NMR spectra of HBPSi-CDs prepared at different temperatures are shown in Fig. S6, we found that the characteristic proton signs of carbide at 7.95 ppm cannot be observed in the spectra of HBPSi-CDs-120 and HBPSi-CDs-160, the probable reason is that the carbide structure of HBPSi was not generated when the hydrothermal treatment temperatures were 120 and 160 °C. A similar phenomenon can be seen in the ^{13}C NMR spectra of HBPSi-CDs.

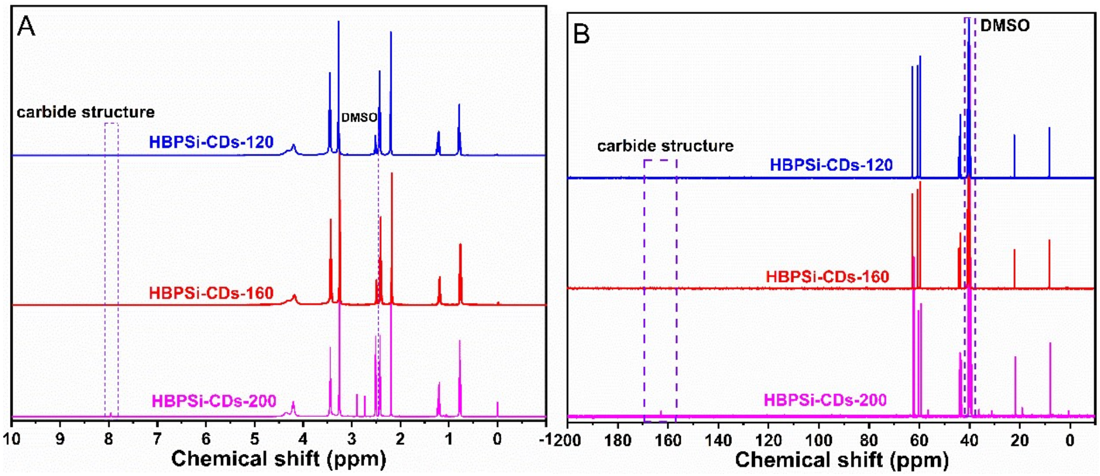

Figure S6. ^{1}H NMR and ^{13}C NMR spectra of HBPSi-CDs prepared at different temperatures.

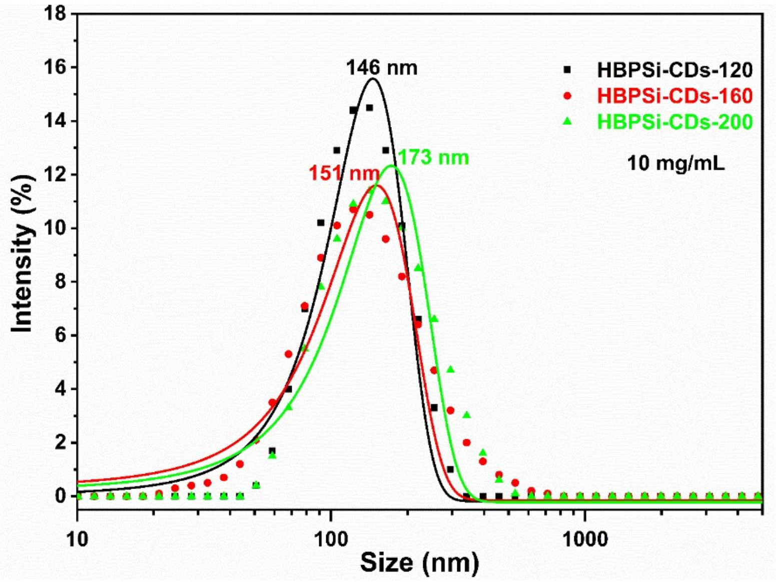

Figure S7. The aggregation sizes of HBPSi-CDs prepared at different temperatures in aqueous solution (10 mg/mL).

6. Fluorescence quantum yield and decay curve of HBPSi in solid state

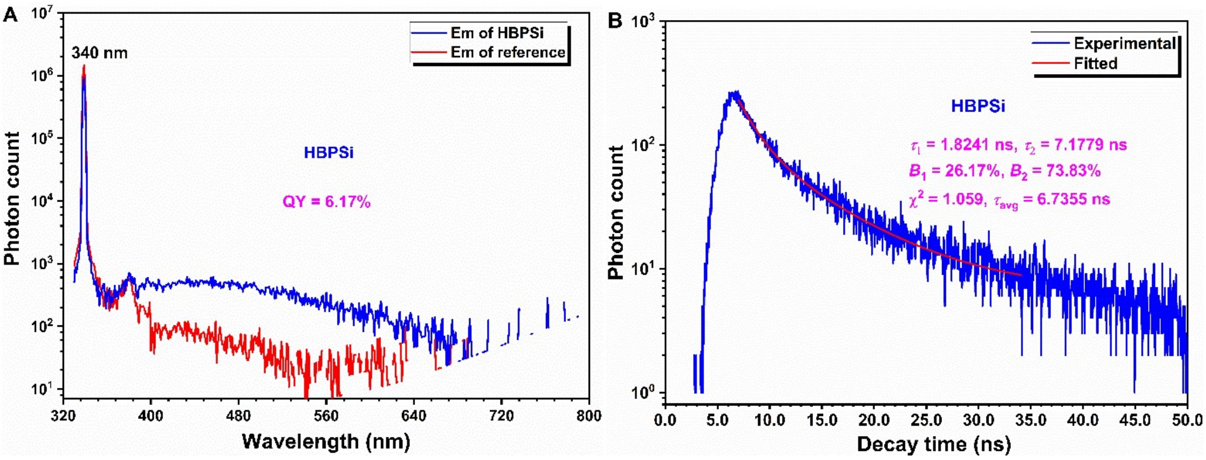

Figure S8. (A) the absolute quantum yield of HBPSi in solid state excited at 340 nm; (B) the transient photoluminescence decay curve of HBPSi in solid state at 413 nm after excitation at 340 nm

7. Fluorescence spectra of HBPSi-CDs-200 in solid state

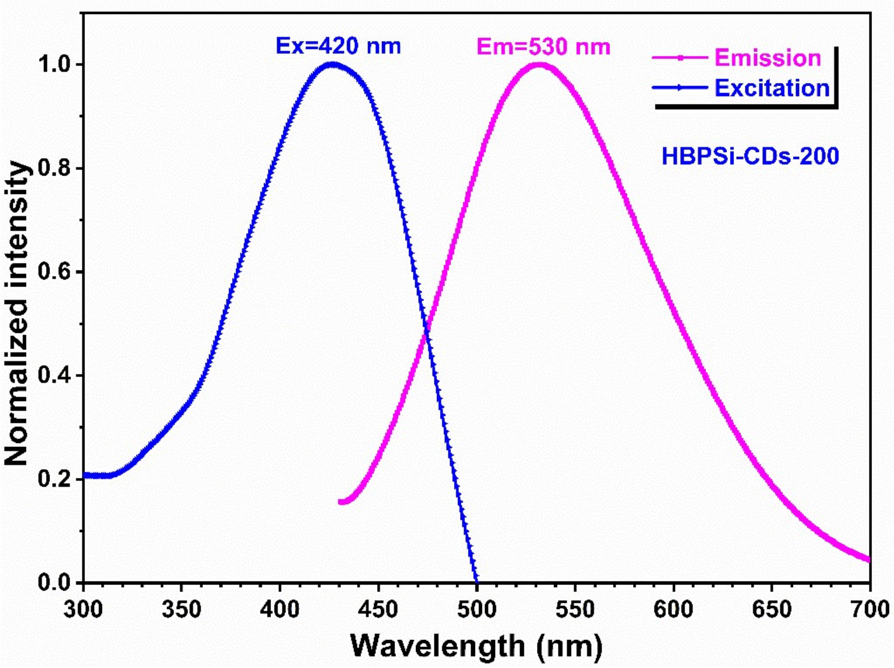

Figure S9. Fluorescence spectra of HBPSi-CDs-200 in solid state: excitation spectra (monitored at λ_{em} = 530 nm) and emission spectra (excited at λ_{ex} = 420 nm)

References:

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