Enhanced charge separation and transport efficiency induced by vertical slices on the surface of carbon nitride for visible-light-driven hydrogen evolution

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### Table S1 BET surface area and weights of the as-synthesized samples.

| Sample          | BET Surface Area (m²/g) | Product weight (g) |
|-----------------|-------------------------|--------------------|
| BCN             | 24.1                    | 0.200              |
| BCN-ht          | 82.9                    | 0.142              |
| H-CN (1.2 g, 24 h, 180 °C) | 64.1                  | 0.153              |
| CN₀.₄ g        | 74.1                    | 0.157              |
| CN₀.₈ g        | 65.1                    | 0.164              |
| CN₁.₀ g        | 63.7                    | 0.171              |

### Table S2 XPS analysis of BCN, BCN-ht and H-CN.

| Binding Energy /eV | Samples          | C-N=C | C=C | C-N=C | N(C) | N-H | C/N from charge effect | C1 | N3 | C/N from XPS |
|--------------------|------------------|-------|-----|-------|------|-----|-------------------------|----|----|---------------|
|                    | BCN              | 288.1 | 284.8 | 398.0 | 398.7 | 400.1 | 404.4 | 6.81 | 0.289 | 0.850         |
|                    | BCN-ht           | 287.9 | 284.8 | 398.2 | 398.7 | 400.3 | 404.4 | 5.68 | 0.184 | 0.847         |
|                    | H-CN             | 288.1 | 284.8 | 398.4 | 398.8 | 400.4 | 404.7 | 7.56 | 0.206 | 0.696         |

### Table S3 Elemental analysis of BCN, BCN-ht and H-CN.

| Sample | C/% Wt. | N/% Wt | H/% Wt | O/% Wt | C/N molar ratio |
|--------|---------|--------|--------|--------|-----------------|
| BCN    | 34.91   | 62.07  | 1.12   | 1.91   | 0.656           |
| BCN-ht | 30.06   | 54.04  | 0.35   | 15.55  | 0.649           |
| H-CN   | 33.02   | 59.49  | 0.40   | 7.09   | 0.647           |

### Table S4 Kinetic parameters of the fitting decay curves of BCN, BCN-ht and H-CN.

| Sample | τ₁ (ns) - %contribution | τ₂ (ns) - %contribution | χ² | ave.τ (ns) |
|--------|--------------------------|--------------------------|----|------------|
| BCN    | 2.0751-50.55             | 7.2390-49.45             | 1.078 | 4.62864855 |
| BCN-ht | 1.3274-49.64             | 4.7958-50.36             | 0.975 | 3.07408624 |
| H-CN   | 1.5577-50.90             | 5.9560-49.10             | 1.097 | 3.7172653  |
Figure S1 SEM images of CN$_{0.4\,g}$ (A), CN$_{0.8\,g}$ (B) and CN$_{1.6\,g}$ (C).

Figure S2 The TEM image of H-CN.

Figure S3 Elemental mapping patterns of H-CN.

Figure S4 SEM images of CN-8 (A), CN-16 (B) and CN-32 (C).
Figure. S5 SEM images of the samples obtained from the hydrothermal treatment systems containing NH₄Cl (A) or NaNO₃ (B).

Figure. S6 The pH values of the supernatants from the two hydrothermal systems for preparing BCN-ht and H-CN under different reaction durations.

Figure. S7 PL spectra of BCN, BCN-ht, and the samples obtained from the hydrothermal treatment with different amounts of NH₄NO₃.
Figure. S8 Mott–Schottky plots for BCN (A) and BCN-ht (B) performed in 0.5 M Na$_2$SO$_4$ at 8, 10 and 12 kHz. (C) Electrochemical impedance spectroscopy (EIS) at 0.20 V vs. Ag/AgCl for H-CN performed in 0.5 M Na$_2$SO$_4$. (Note that the real part of the impedance is constant above 1 kHz, while the imaginary part has a slope of -1. This implies that the system behaves as a resistance in series with a pure capacitance, which is a prerequisite for Mott-Schottky analysis.)

Figure. S9 Photocatalytic hydrogen evolution rates of samples obtained from the hydrothermal treatment at different temperatures.
Figure. S10 SEM (A) and TEM images (B) of H-CN after photocatalytic reaction.

Figure. S11 FT-IR spectra of BCN, BCN-ht and H-CN. The intense peak at 807 cm$^{-1}$ is assigned to breathing mode of heptazine ring systems. The peaks in the region from 1700 to 1200 cm$^{-1}$ are identified to skeletal vibration of C-N heterocycles. And the broad band between 3260-3070 cm$^{-1}$ range correspond to the symmetric –NH and C-H vibration in the aromatic system, in which the difference of intensity mainly because of the adsorbed water molecular.