Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Table of Contents

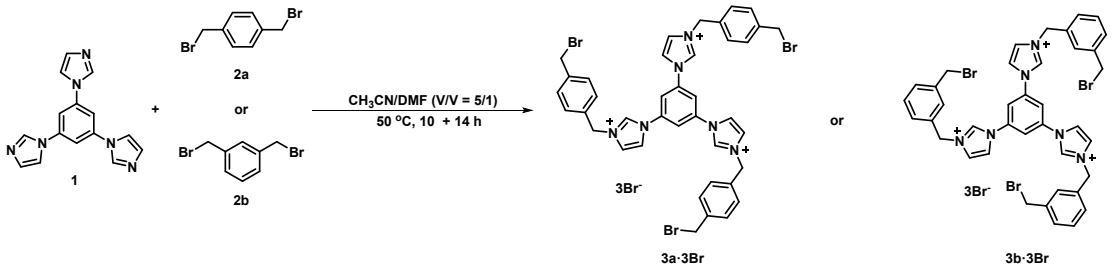
1. General Information

All commercially available reagents were used as received. TLC analysis was performed on pre-coated, glass-backed silica gel plates and visualized with UV light. Flash column chromatography was performed on Silicycle Silica Flash@P60 (300–400 mesh). Anhydrous solvents (dichloromethane, chloroform, tetrahydrofuran, Dimethylformamide, Dimethyl sulfoxide, and acetonitrile) were dried by 4 Å molecular sieves. ^{1}H NMR and ^{13}C NMR spectra were recorded on a Bruker® AVANCE III HD 400 MHz NMR spectrometer. Chemical shifts were reported in ppm with either tetramethylsilane or the residual solvent resonance an internal standard. Abbreviations are used in the description of NMR data as follows: chemical shift (δ, ppm), multiplicity (s = singlet, d = doublet, t = triplet, q = quadruplet), coupling constant (J, Hz). Infrared spectra were recorded using a Thermo Fisher® Nicolet 6700 spectrometer with KBr pellets in the 4000 - 400 cm^{-1} region. UV-vis spectra were recorded using a PerkinElmer® Lambda 35 UV-vis spectrophotometer. Fluorescence spectra were recorded using an Agilent® Eclipse fluorescence spectrophotometer. Crystallographic data were collected on a Bruker® APEX-II CCD (Ga) **X**-ray single crystal diffractometer. Reversed-phase high performance liquid chromatography were recorded using an Agilnt® Agilnt 1260 (C18). Isothermal titration calorimetry (ITC) experiments were performed by Malvern MicroCal PEAQ-ITC. Mass spectrometry were recorded using a Water G2-xs TOF. Melting points were uncorrected. Rat red blood cells (5%) purchased from Guangzhou Hongquan Biotechnology Co., Ltd.

2. Experimental Procedures and Characterization of Products

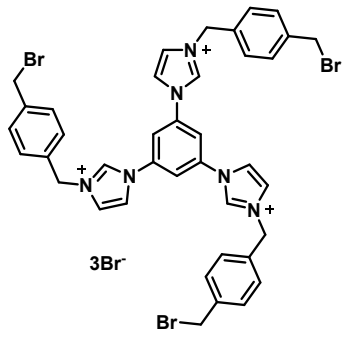
1,1'-(5-(4H-imidazol-4-yl)-1,3-phenylene)bis(1H-imidazole) **1**[1] was synthesized according to literature procedures.

Synthesis of compound 3a·3Br and 3b·3Br.



A solution of **2a** or **2b** (3.96 g, 15.0 mmol, 15.0 equiv.) in anhydrous acetonitrile (100 mL) was pre-heated to 50 °C. To which was added dropwise a solution of **1** (276 mg, 1.0 mmol, 1.0 equiv.) in anhydrous dimethylformamide (20 mL) over 10 h. The mixture was allowed to react for another 14 h. After cooling to room temperature, suction filtration gave a white solid. After washed with dichloromethane, the crude product was recrystallized using methanol and water to give pure product **3a·3Br** or **3b·3Br**.

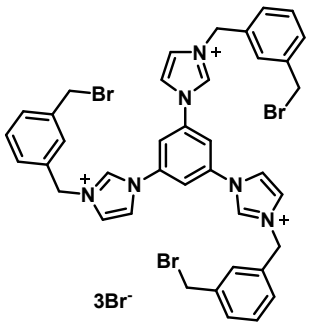
3a·3Br



Chemical Formula: $C_{39}H_{36}Br_6N_6$; Molecular Weight: 1068.1830

3a·3Br (908 mg, yield 85%): white solid; **m.p.** 176–179 °C; **^{1}H NMR** (400 MHz, DMSO-d_6) δ 10.24 (s, 3H), 8.60 (s, 3H), 8.50 (s, 3H), 8.21 (s, 3H), 7.56 - 7.51 (m, 12H), 5.61 (s, 6H), 4.73 (s, 6H); **^{13}C NMR** (101 MHz, DMSO-d_6) δ 139.0, 136.3, 134.2, 130.0, 128.9, 123.9, 121.7, 116.3, 52.5, 33.7; **IR** (KBr) *v* 3416, 3057, 1623, 1570, 1549, 1447, 1364, 1228, 1096, 1010, 852, 767, 605 cm^{-1}; **HRMS (ESI)** Calculated for $C_{39}H_{36}Br_5N_6^+$: 986.8872, Found: 986.8866.

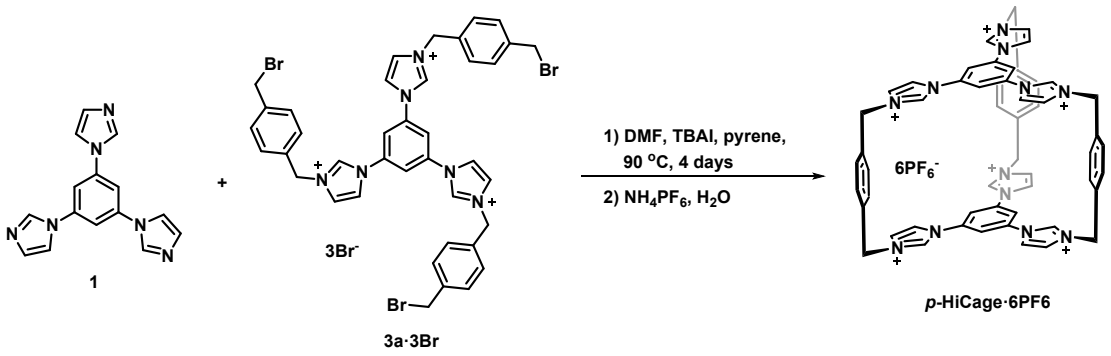
3b·3Br



Chemical Formula: $C_{39}H_{36}Br_6N_6$; Molecular Weight: 1068.1830

3b·3Br (931 mg, yield 87%): white solid; **m.p.** 185–189 °C; **^{1}H NMR** (400 MHz, DMSO-d_6) δ 10.31 (s, 3H), 8.65 (s, 3H), 8.54 (s, 3H), 8.21 (s, 3H), 7.65 (s, 3H), 7.52–7.51 (m, 3H), 7.48–7.47 (m, 6H), 5.62 (s, 6H), 4.73 (s, 6H); **^{13}C NMR** (101 MHz, DMSO-d_6) δ 139.0, 136.4, 136.3, 134.6, 130.0, 129.5, 129.3, 128.5, 123.9, 121.7, 116.3, 52.5, 33.8; **IR** (KBr) *v* 3416, 3047, 1621, 1572, 1548, 1490, 1445, 1215, 1095, 769, 623 cm^{-1}; **HRMS (ESI)** Calculated for $C_{39}H_{36}Br_5N_6^+$: 986.8872, Found: 986.8869.

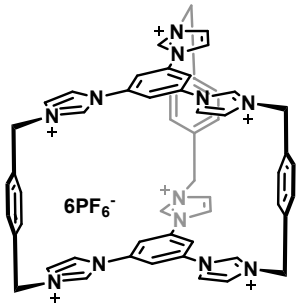
Synthesis of compound *p*-HiCage·6PF$_6$.



Pyrene as template. 3a·3Br (107 mg, 0.1 mmol, 1.0 equiv.) was dispersed in dimethylformamide solution in which **1** (27.6 mg, 0.1 mmol, 1.0 equiv.) was dissolved. The mixture was kept stirring with TBAI (11.1 mg, 0.03 mmol, 0.3 equiv.) and pyrene (121 mg, 0.6 mmol, 6.0 equiv.) for 4 days at 90 °C. After cooling to room temperature, excess TBACl was added to precipitate the crude product. After filtration to remove solvent, the residue was washed with dichloromethane and then chromatographed on a silica gel column with a mixture of methanol, water and saturated ammonium chloride solution (6 : 3 : 1, v/v) as the mobile phase. The chromatographically pure compound was precipitated by adding NH_4PF_6 to the eluent, affording pure ***p*-HiCage·6PF$_6$** (43.0 mg, 25%).

Uric acid as template. 3a·3Br (107 mg, 0.1 mmol, 1.0 equiv.) was dispersed in dimethylformamide solution in which **1** (27.6 mg, 0.1 mmol, 1.0 equiv.) was dissolved. The mixture was kept stirring with TBAI (11.1 mg, 0.03 mmol, 0.3 equiv.) and uric acid (101 mg, 0.6 mmol, 6.0 equiv.) for 4 days at 90 °C. Post-treatment and purification methods were the same as above, affording pure ***p*-HiCage·6PF$_6$** (54.3 mg, 31%).

***p*-HiCage·6PF$_6$**

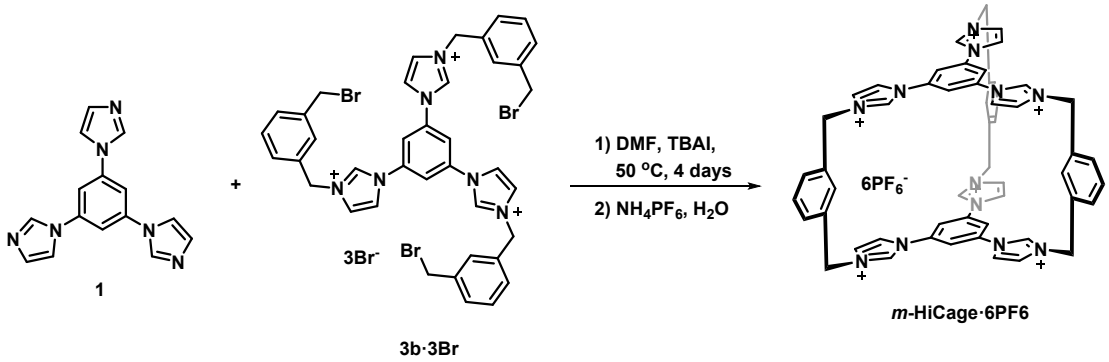


Chemical Formula: $C_{54}H_{48}F_{36}N_{12}P_6$; Molecular Weight: 1734.8471

***p*-HiCage·6PF$_6$**: white solid; **m.p.** >300 °C; **^{1}H NMR** (400 MHz, DMSO-d_6) δ 9.40 (s, 6H), 8.36 (t, J = 1.8 Hz, 6H), 8.32 (t, J = 1.9 Hz, 6H), 8.19 (s, 6H), 7.43 (s, 12H), 5.58 (s, 12H); **^{13}C NMR** (101 MHz, DMSO-d_6) δ 135.8, 135.5, 135.1, 129.0, 125.2, 120.6, 116.1, 52.6; **IR** (KBr) v 3641 3428 3156 3117 3095 1627 1573 1555 1182 1099 838 559

cm^{-1}; **HRMS (ESI)** Calculated for $C_{54}H_{48}F_{30}N_{12}P_5^+$: 1589.2328, Found: 1589.2326.

Synthesis of compound *m*-HiCage·6PF$_6$.

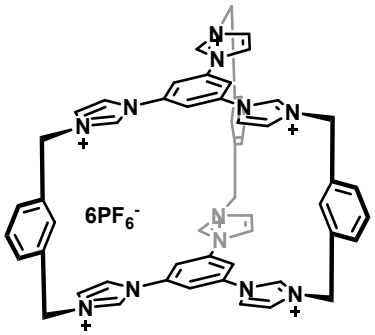


3b·3Br

No template. 3b·3Br (107 mg, 0.1 mmol, 1.0 equiv.) was dispersed in dimethylformamide solution in which **1** (27.6 mg, 0.1 mmol, 1.0 equiv.) was dissolved. The mixture was kept stirring with TBAI (11.1 mg, 0.03 mmol, 0.3 equiv.) for 4 days at 50 °C. After cooling to room temperature, excess TBACl was added to precipitate the crude product. After filtration to remove solvent, the residue was washed with dichloromethane and then chromatographed on a silica gel column with a mixture of methanol, water and saturated ammonium chloride solution (6 : 3 : 1, v/v) as the mobile phase. The chromatographically pure compound was precipitated by adding NH_4PF_6 to the eluent, affording pure *m*-**HiCage·6PF$_6$** (24.6 mg, 14%).

Uric acid as template. 3b·3Br (107 mg, 0.1 mmol, 1.0 equiv.) was dispersed in dimethylformamide solution in which **1** (27.6 mg, 0.1 mmol, 1.0 equiv.) was dissolved. The mixture was kept stirring with TBAI (11.1 mg, 0.03 mmol, 0.3 equiv.) and uric acid (101 mg, 0.6 mmol, 6.0 equiv.) for 4 days at 50 °C. Post-treatment and purification methods were the same as above, affording pure *m*-**HiCage·6PF$_6$** (44.1 mg, 25%).

m-**HiCage·6PF$_6$**

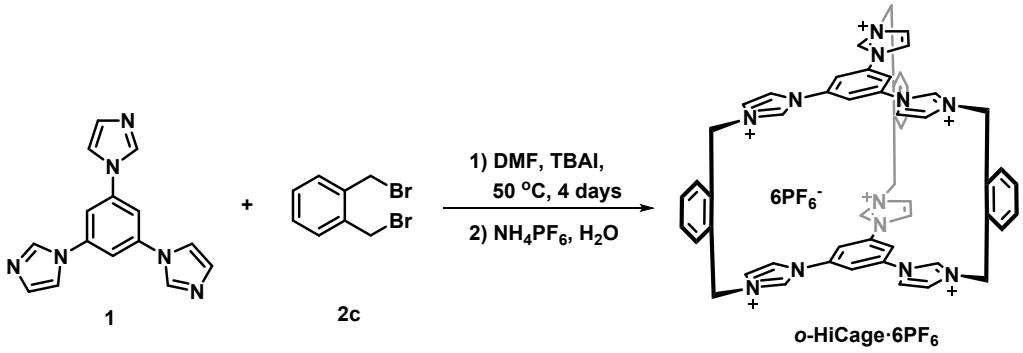


Chemical Formula: $C_{54}H_{48}F_{36}N_{12}P_6$; Molecular Weight: 1734.8471

p-**HiCage·6PF$_6$**: white solid; **m.p.** >300 °C; **^{1}H NMR** (400 MHz, DMSO-d_6) δ 9.57 (s, 6H), 8.32 (s, 6H), 8.25 (t, J = 1.8 Hz, 6H), 8.22 (t, J = 2.0 Hz, 6H), 7.71−7.64 (m, 9H), 6.66 (s, 3H), 5.66 (s, 12H); **^{13}C NMR** (101 MHz, DMSO-d_6) δ 136.1, 135.4, 135.1, 129.9, 129.1, 125.1, 121.1, 115.1, 52.6; **IR** (KBr) v 3640 3440 3161 3095 1627 1578 1556

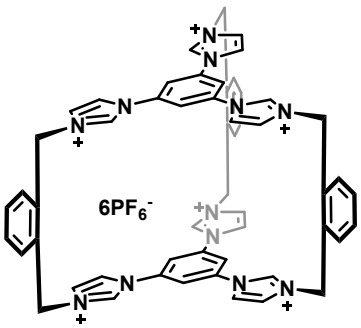
1194 1103 838 558 cm^{-1}; **HRMS (ESI)** Calculated for $C_{54}H_{48}F_{30}N_{12}P_5^+$: 1589.2328, Found: 1589.2322.

Synthesis of compound *o*-HiCage·6PF$_6$.



A solution of **1** (55.2 mg, 0.2 mmol 1.0 equiv.), **2c** (79.2 mg, 0.3 mmol, 1.5 equiv.) and TBAI (11.1 mg, 0.03 mmol, 0.15 equiv.) was stirred at 50 °C for 4 days. After cooling to room temperature, excess TBACl was added to precipitate the crude product. After filtration to remove solvent, the residue was washed with dichloromethane and then chromatographed on a silica gel column with a mixture of methanol, water and saturated ammonium chloride solution (6 : 3 : 1, v/v) as the mobile phase. The chromatographically pure compound was precipitated by adding NH_4PF_6 to the eluent, affording pure *o*-**HiCage·6PF$_6$**.

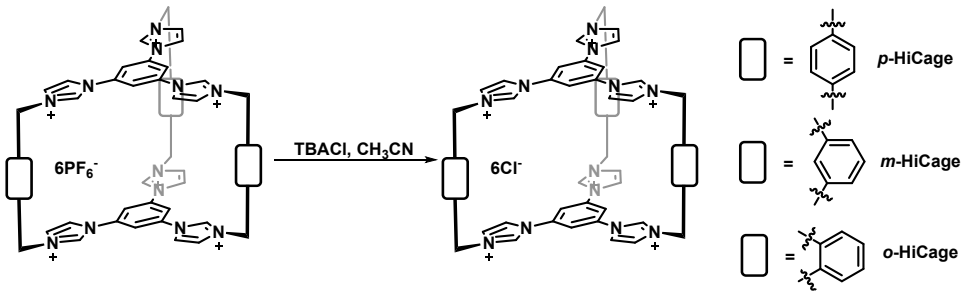
o-**HiCage·6PF$_6$**



Chemical Formula: $C_{54}H_{48}F_{36}N_{12}P_6$; Molecular Weight: 1734.8471

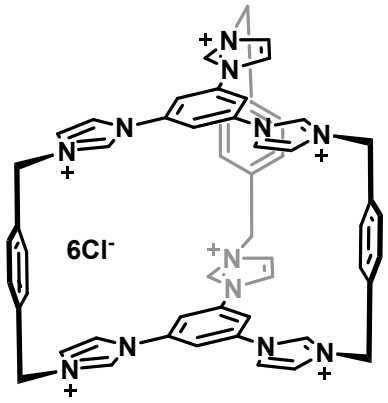
o-**HiCage·6PF$_6$** (33.2 mg, yield 19%): white solid; **m.p.** >300 °C; **^{1}H NMR** (400 MHz, DMSO-d_6) δ 9.72 (s, 6H), 8.15 (s, 12H), 7.97 (t, J = 4.7 Hz, 6H), 7.86 (t, J = 4.5, Hz, 6H), 7.70 (s, 6H), 5.82 (s, 12H); **^{13}C NMR** (101 MHz, DMSO-d_6) δ 135.6, 134.3, 131.6, 123.9, 120.5, 113.2, 51.4; **IR** (KBr) v 3439 3147 3086 2985 1622 1573 1545 1192 1105 838 561 cm^{-1}; **HRMS (ESI)** Calculated for $C_{54}H_{48}F_{24}N_{12}P_4^{2+}$: 722.1341, Found: 722.1337.

Synthesis of compound *p*-HiCage·6Cl, *m*-HiCage·6Cl and *o*-HiCage·6Cl.



HiCage·6PF$_6$ was dissolved in water followed by the addition of excess TBACl, resulting in the precipitation of pure **HiCage·6Cl** that was collected by filtration as a white solid.

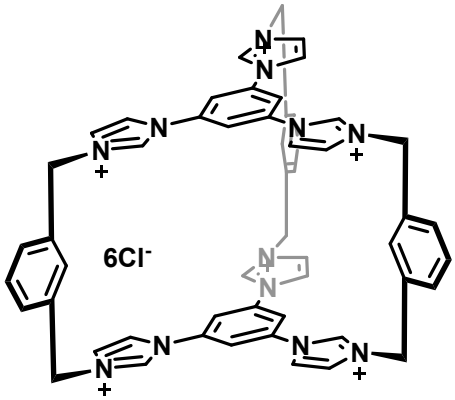
***p*-HiCage·6Cl**



Chemical Formula: $C_{54}H_{48}Cl_6N_{12}$; Molecular Weight: 1077.1620

***p*-HiCage·6Cl:** white solid; **m.p.** 285–287 °C (decomp.); **^{1}H NMR** (400 MHz, D_2O) δ 8.01 (s, 6H), 8.00 (s, 6H), 7.97 (s, 6H), 7.58 (s, 12H), 5.56 (s, 12H); **^{13}C NMR** (101 MHz, D_2O) δ 137.5, 135.4, 130.8, 125.2, 122.3, 119.3, 54.2, (δ 39.4, DMSO as internal reference); **IR** (KBr) *v* 3424 3130 3078 1624 1569 1547 1351 1215 1179 1104 1095 cm^{-1}; **HRMS (ESI)** Calculated for $C_{54}H_{48}Cl_5N_{12}^+$: 1041.2533, Found: 1041.2527.

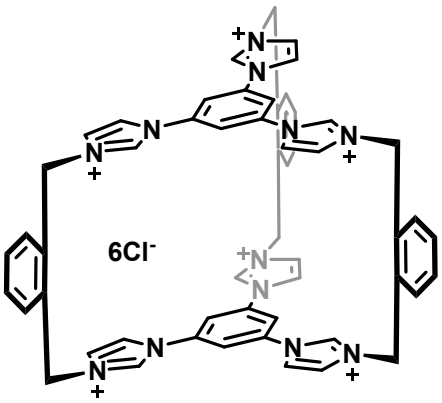
***m*-HiCage·6Cl**



Chemical Formula: $C_{54}H_{48}Cl_6N_{12}$; Molecular Weight: 1077.1620

***m*-HiCage·6Cl:** white solid; **m.p.** 279 - 282 °C (decomp.); **^{1}H NMR** (400 MHz, D_2O) δ 8.07 (s, 6H), 8.04 (d, *J* = 2.1 Hz, 6H), 7.88 (d, *J* = 2.1 Hz, 6H), 7.76 (d, *J* = 7.6 Hz, 6H), 7.70 (t, J = 8.0 Hz, 3H), 7.41 (s, 3H), 5.57 (s, 12H); **^{13}C NMR** (101 MHz, D_2O) δ 137.6, 134.7, 131.5, 131.1, 129.4, 124.4, 122.5, 118.3, 53.9. (δ 39.4, DMSO as internal reference); **IR** (KBr) *v* 3420 3133 3058 1625 1573 1552 1491 1444 1367 1199 1094 cm^{-1}; **HRMS (ESI)** Calculated for $C_{54}H_{48}Cl_5N_{12}^+$: 1041.2533, Found: 1041.2533.

***o*-HiCage·6Cl**

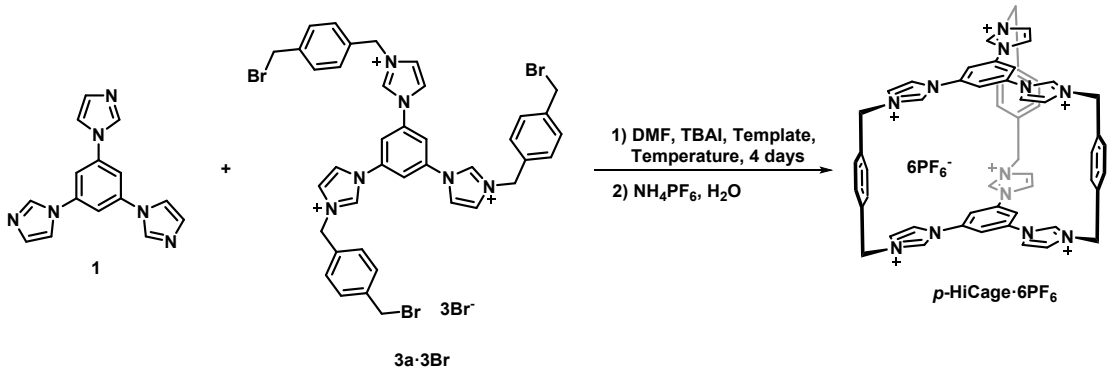


Chemical Formula: $C_{54}H_{48}Cl_6N_{12}$; Molecular Weight: 1077.1620

***o*-HiCage·6Cl:** white solid; **m.p.** 262 - 265 °C (decomp.); **^{1}H NMR** (400 MHz, D_2O) δ 8.17 (d, *J* = 2.2 Hz, 6H), 8.08 (s, 6H), 7.90 (d, *J* = 1.8 Hz, 12H), 7.84 (d, *J* = 2.2 Hz, 6H), 5.81 (s, 12H); **^{13}C NMR** (101 MHz, D_2O) δ 137.1, 135.3, 133.1, 131.6, 125.3, 121.8, 115.2, 52.9. (δ 39.4, DMSO as internal reference); **IR** (KBr) *v* 3424 3127 3077 2984 1622 1574 1545 1330 1226 1191 1094 cm^{-1}; **HRMS (ESI)** Calculated for $C_{54}H_{48}Cl_5N_{12}^+$: 1041.2533, Found: 1041.2539.

3. Template synthesis of HiCage·6PF$_6$

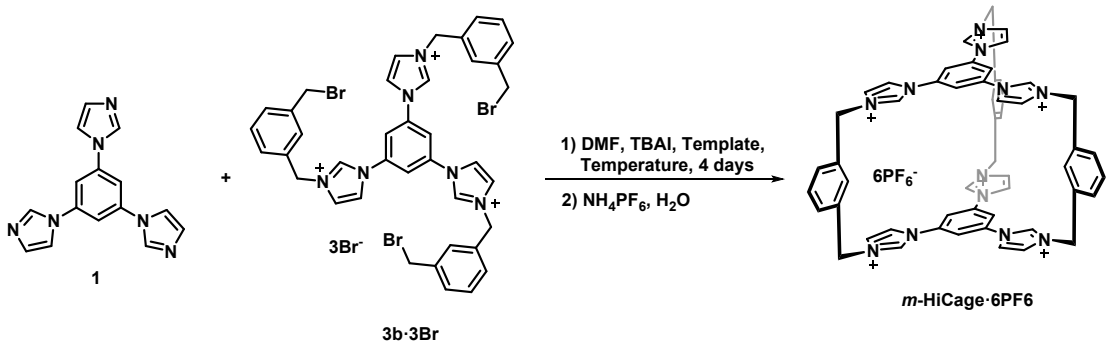
Table S1. Reaction of **3a·3Br** with **1.**[a]



Entry	T/°C	Template	Yield (%)
1	90	Pyrene	25
2	90	Coronene	7
3	90	1,5-Dimethoxynaphthalene	23
4	90	Naphthalene	21
5	90	-	12
6	120	-	trace
7	reflux	-	trace
8	70	-	10
9	50	-	8
10	r.t.	-	7

a. A mixture of **1** (27.6 mg, 0.1 mmol, 1.0 equiv.), **3a·3Br** (107 mg, 0.1 mmol, 1.0 equiv.) and TBAI (11.1 mg, 0.03 mmol, 0.3 equiv.) was kept stirring with template (0.6 mmol, 6.0 equiv.) for 4 days.

Table S2. Reaction of **3b·3Br** with **1.**[a]



Entry	T/ºC	Template	Yield (%)
1	50	Pyrene	12
2	50	Coronene	10
3	50	1,5-Dimethoxynaphthalene	11
4	50	Naphthalene	14
5	90	-	trace
6	70	-	trace
7	50	-	14
8	r.t.	-	9

a. A mixture of **1** (27.6 mg, 0.1 mmol, 1.0 equiv.), **3b·3Br** (107 mg, 0.1 mmol, 1.0 equiv.) and TBAI (11.1 mg, 0.03 mmol, 0.3 equiv.) was kept stirring with template (0.6 mmol, 6.0 equiv.) for 4 days.

Table S3. The binding constants (K_a) for complexation of ***p*-HiCage** and ***m*-HiCage** with pyrene, naphthalene and coronene.

	Pyrene (M^{-1})[a]	**Naphthalene** (M^{-1})[a]	**Coronene** (M^{-1})[b]
***p*-HiCage**	$(3.83 \pm 0.09) \times 10^2$	$(2.12 \pm 0.04) \times 10$	< 5
***m*-HiCage**	< 5	< 5	< 5

a. The binding constants was determined by NMR titration. ***b***. The binding constants was determined by fluorescence titration.

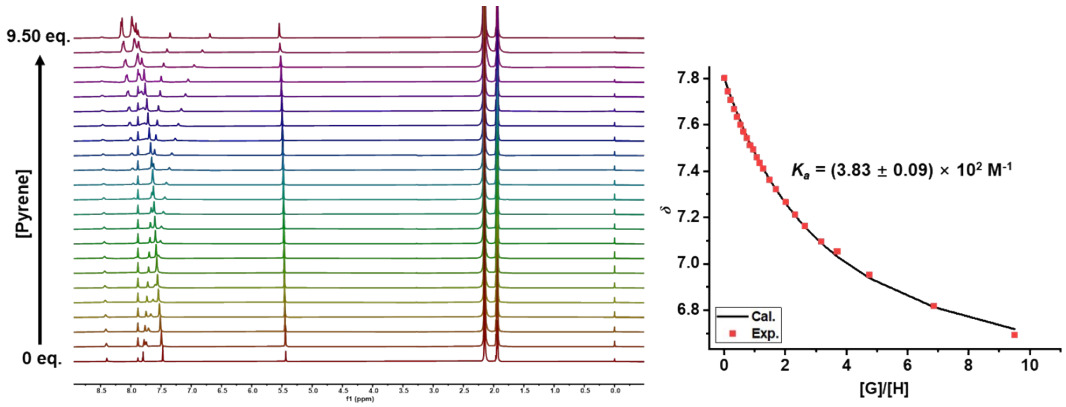


Figure S1 (Left) ^{1}H NMR titration spectra (400 MHz, CD_3CN, 25 °C,) recorded for a solution of *p*-**HiCage·6PF$_6$** (0.9799 mM) and pyrene with variable concentrations (0–9.50 equiv.). (Right) Plot of the chemical shift of *p*-**HiCage·6PF$_6$** as a function of [G]/*p*-**HiCage·6PF$_6$**.

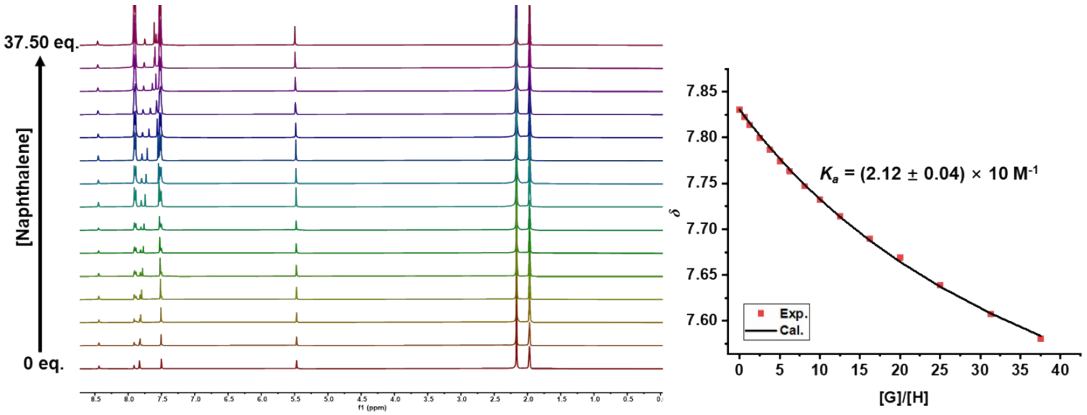


Figure S2 (Left) ^{1}H NMR titration spectra (400 MHz, CD_3CN, 25 °C,) recorded for a solution of *p*-**HiCage·6PF$_6$** (1.038 mM) and naphthalene with variable concentrations (0–37.50 equiv.). (Right) Plot of the chemical shift of *p*-**HiCage·6PF$_6$** as a function of [G]/*p*-**HiCage·6PF$_6$**.

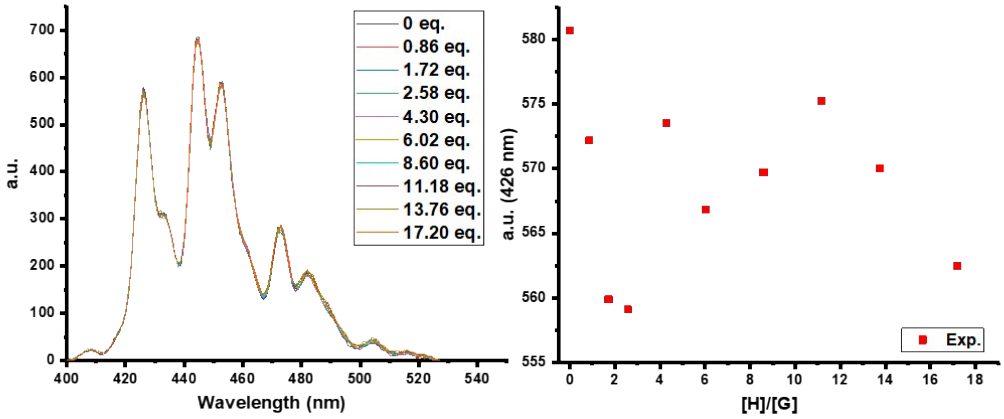


Figure S3 (Left) Fluorescence titration spectra at 25 °C of coronene (24.14 μM) with addition of 0-17.20 equiv. of *p*-**HiCage·6PF$_6$** in CH_3CN. (Right) Plot of a.u. (426 nm) against [*p*-**HiCage·6PF$_6$**]/[coronene].

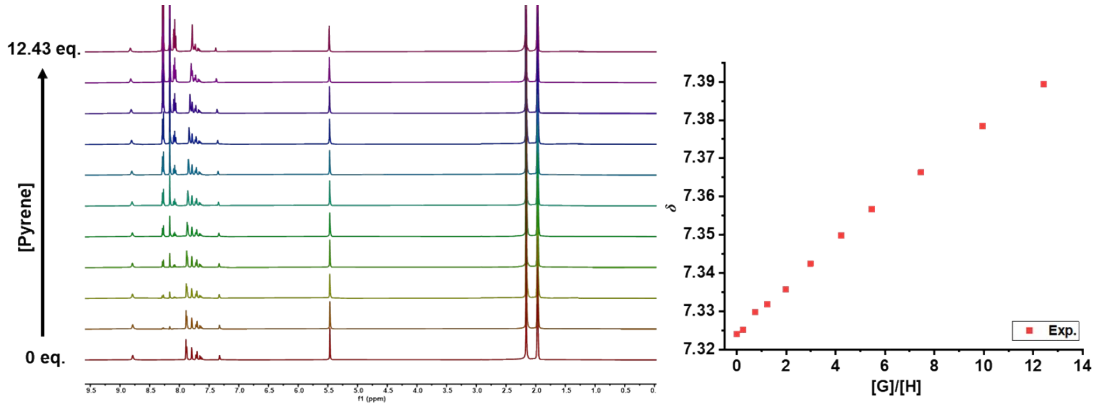


Figure S4 (Left) ^{1}H NMR titration spectra (400 MHz, CD_3CN, 25 ºC,) recorded for a solution of *m*-**HiCage·6PF$_6$** (1.095 mM) and pyrene with variable concentrations (0–12.43 equiv.). (Right) Plot of the chemical shift of *m*-**HiCage·6PF$_6$** as a function of [G]/*m*-**HiCage·6PF$_6$**.

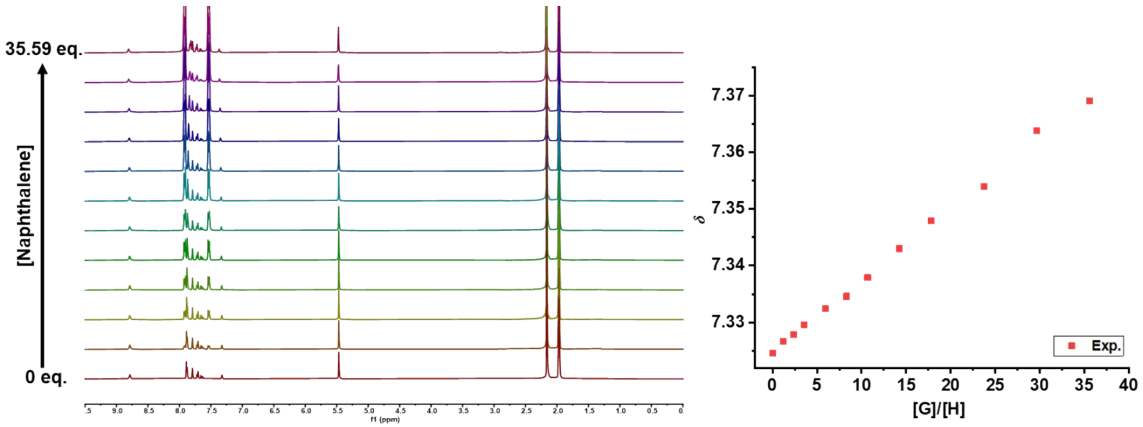


Figure S5 (Left) ^{1}H NMR titration spectra (400 MHz, CD_3CN, 25 ºC,) recorded for a solution of *m*-**HiCage·6PF$_6$** (1.095 mM) and naphthalene with variable concentrations (0–35.59 equiv.). (Right) Plot of the chemical shift of *m*-**HiCage·6PF$_6$** as a function of [G]/*m*-**HiCage·6PF$_6$**.

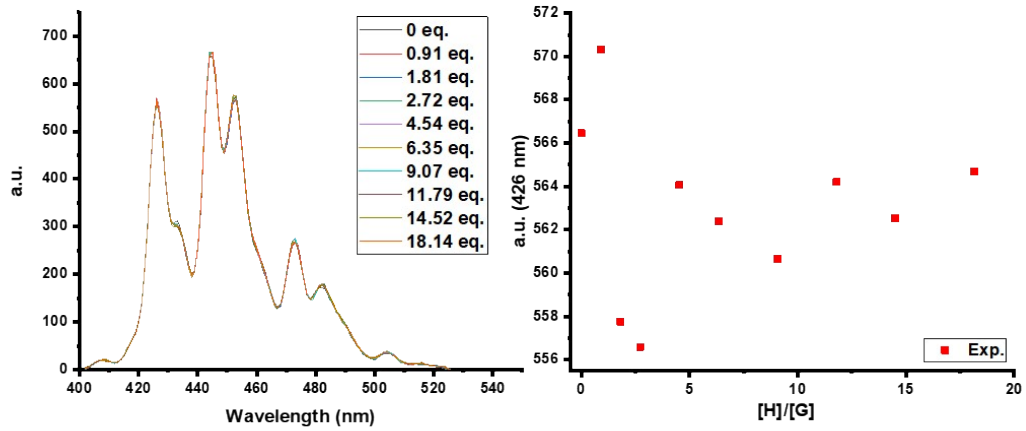


Figure S6 (Left) Fluorescence titration spectra at 25 ºC of coronene (24.14 μM) with addition of 0-18.14 equiv. of *m*-**HiCage·6PF$_6$** in CH_3CN. (Right) Plot of a.u. (426 nm) against [*m*-**HiCage·6PF$_6$**]/[coronene].

4. Crystal Data and X-Ray Molecular Structures

High-quality single crystals of products *p*-**HiCage·6PF$_6$**, *m*-**HiCage·6PF$_6$** *p*-**HiCage·6Cl**, *m*-**HiCage·6Cl** and *o*-**HiCage·6Cl** were obtained by slow vapor diffusion of methanol or isopropanol into the acetonitrile solution of *p*-**HiCage·6PF$_6$**, and *m*-**HiCage·6PF$_6$** or aqueous solution of *p*-**HiCage·6Cl**, *m*-**HiCage·6Cl** and *o*-**HiCage·6Cl**. Crystal data and X-ray molecular structures with their CCDC numbers are reported as follows. CIFs and CheckCIFs are provided in separated files as Supplementary Information. Following each Table of crystal data and structure refinement for compounds, we also provide explanations for any A- level alerts in the CheckCIF output.[2-3]

Table S4. Crystal data and structure refinement for *p*-**HiCage·6PF$_6$.**

Empirical formula	$C_{62}H_{65}F_{36}N_{15}O_2P_6$
Formula weight	1922.11
Temperature/K	173
Crystal system	triclinic
Space group	P-1
a/Å	13.4665(4)
b/Å	14.5992(5)
c/Å	23.4728(7)
α/°	87.8340(10)
β/°	74.7390(10)

γ/°	65.6540(10)
Volume/Å^3	4043.0(2)
Z	2
ρ_{calc}/g/cm^3	1.579
μ/mm^{-1}	1.604
F(000)	1944.0
Crystal size/mm^3	0.3 × 0.3 × 0.2
Radiation	Ga Kα (λ = 1.34138)
2Θ range for data collection/°	5.8 to 102.68
Index ranges	-15 ≤ h ≤ 15, -16 ≤ k ≤ 16, -27 ≤ l ≤ 27
Reflections collected	75671
Independent reflections	12834 [R_{int} = 0.0326, R_{sigma} = 0.0267]
Data/restraints/parameters	12834/0/1097
Goodness-of-fit on F^2	1.049
Final R indexes [I>=2σ (I)]	R_1 = 0.0902, wR_2 = 0.2270
Final R indexes [all data]	R_1 = 0.0926, wR_2 = 0.2284
Largest diff. peak/hole / e Å^{-3}	1.44/-0.99
CCDC number	2294230

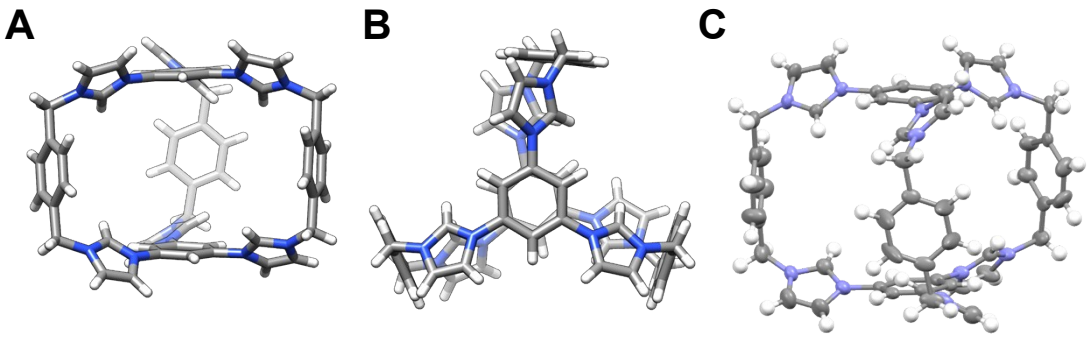


Figure S7. X-ray molecular structure of *p*-**HiCage·6PF$_6$** with side (A) and top (B) views. (C) The molecules is depicted in stick-ellipsoid style at 50% probability level for all atoms. The other anions and all solvent molecules in a unit cell were omitted for clarity.

Table S5. Crystal data and structure refinement for *p*-**HiCage·6Cl.**

Empirical formula	$C_{114}H_{114}Cl_{12}N_{24}O_3$

Formula weight	2293.69
Temperature/K	173
Crystal system	triclinic
Space group	P-1
a/Å	11.2346(6)
b/Å	15.4678(9)
c/Å	19.7552(11)
α/°	85.950(2)
β/°	86.117(2)
γ/°	73.280(2)
Volume/Å^3	3275.6(3)
Z	1
ρ_{calc}/g/cm^3	1.163
μ/mm^{-1}	1.824
F(000)	1194.0
Crystal size/mm^3	0.3 × 0.2 × 0.1
Radiation	Ga Kα (λ = 1.34138)
2Θ range for data collection/°	6.334 to 96.646
Index ranges	-12 ≤ h ≤ 12, -17 ≤ k ≤ 17, -21 ≤ l ≤ 19
Reflections collected	26671
Independent reflections	9309 [R_{int} = 0.0491, R_{sigma} = 0.0522]
Data/restraints/parameters	12834/0/1097
Goodness-of-fit on F^2	1.046
Final R indexes [I>=2σ (I)]	R_1 = 0.0848, wR_2 = 0.2285
Final R indexes [all data]	R_1 = 0.0972, wR_2 = 0.2413
Largest diff. peak/hole / e Å^{-3}	1.31/-0.83
CCDC number	2294231

CheckCIF shows a B-level alert for *p*-**HiCage·6Cl.**

PROBLEM: THETM01_ALERT_3_B The value of sine(theta_max)/wavelength is less than 0.575.
Calculated sin(theta_max)/wavelength = 0.5568.

RESPONSE: Weak absorption in high angle of the single crystal causes this problem.

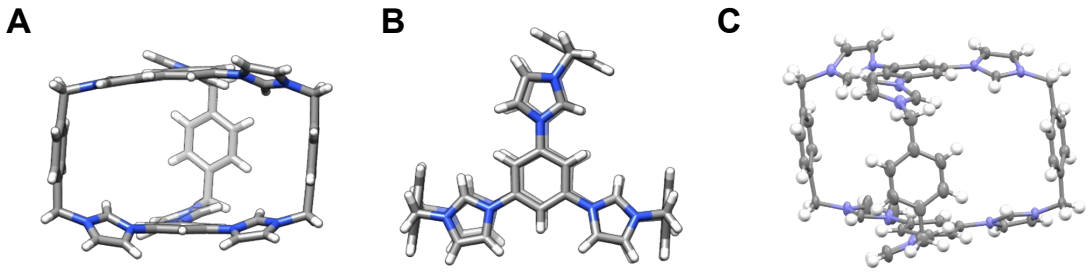


Figure S8. X-ray molecular structure of *p*-**HiCage·6Cl** with side (A) and top (B) views. (C) The molecules is depicted in stick-ellipsoid style at 50% probability level for all atoms. The other anions and all solvent molecules in a unit cell were omitted for clarity.

Table S6. Crystal data and structure refinement for *m*-**HiCage·6PF$_6$.**

Empirical formula	$C_{54}H_{48}F_{36}N_{12}P_6$
Formula weight	1734.86
Temperature/K	173
Crystal system	trigonal
Space group	P3
a/Å	19.6656(12)
b/Å	19.6656(12)
c/Å	10.8033(10)
α/°	90
β/°	90
γ/°	120
Volume/Å^3	3618.3(6)
Z	2
ρ_{calc}/g/cm^3	1.592
μ/mm^{-1}	1.717
F(000)	1740.0
Crystal size/mm^3	0.11 × 0.09 × 0.08
Radiation	Ga Kα (λ = 1.34138)
2Θ range for data collection/°	7.118 to 118.846

Index ranges	$-25 \le h \le 25, -25 \le k \le 23, -13 \le l \le 13$
Reflections collected	50191
Independent reflections	10537 [R_{int} = 0.0692, R_{sigma} = 0.0504]
Data/restraints/parameters	10537/25/733
Goodness-of-fit on F^2	1.072
Final R indexes [I>=2σ (I)]	R_1 = 0.0997, wR_2 = 0.2658
Final R indexes [all data]	R_1 = 0.1139, wR_2 = 0.2780
Largest diff. peak/hole / e $Å^{-3}$	0.93/-0.54
CCDC number	2294232

CheckCIF shows a B-level alert for *m*-**HiCage·6PF$_6$.**

PROBLEM: PLAT340_ALERT_3_B Low Bond Precision on C-C Bonds. 0.01893 Ang.

RESPONSE: This is likely related to the weak diffraction of the crystal.

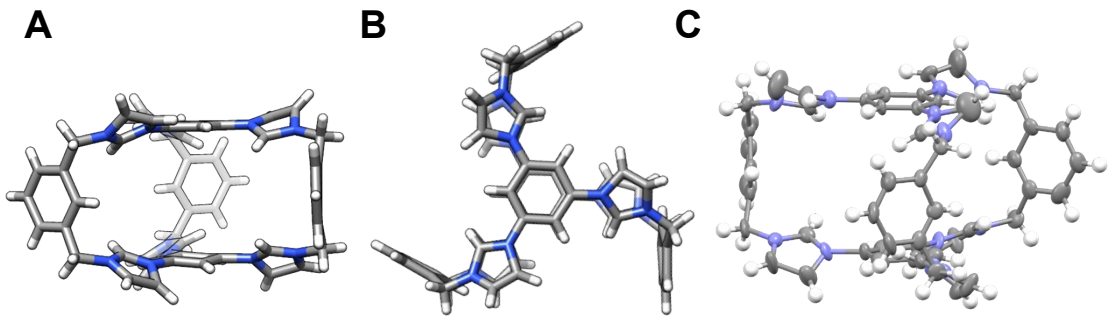


Figure S9. X-ray molecular structure of *m*-**HiCage·6PF$_6$** with side (A) and top (B) views. (C) The molecules is depicted in stick-ellipsoid style at 50% probability level for all atoms. The other anions and all solvent molecules in a unit cell were omitted for clarity.

Table S7. Crystal data and structure refinement for *m*-**HiCage·6Cl.**

Empirical formula	$C_{114}H_{114}Cl_{12}N_{24}O_3$
Formula weight	2293.69
Temperature/K	173
Crystal system	triclinic
Space group	P-1
a/Å	10.0332(4)
b/Å	15.2646(6)

c/Å	21.4545(8)
α/°	110.7920(10)
β/°	93.975(2)
γ/°	91.492(2)
Volume/Å^3	3059.9(2)
Z	1
ρ_{calc}/g/cm^3	1.245
μ/mm^{-1}	1.952
F(000)	1194.0
Crystal size/mm^3	0.05 × 0.015 × 0.01
Radiation	Ga Kα (λ = 1.34138)
2Θ range for data collection/°	7.658 to 99.45
Index ranges	-11 ≤ h ≤ 11, -17 ≤ k ≤ 17, -24 ≤ l ≤ 24
Reflections collected	27047
Independent reflections	9374 [R_{int} = 0.0425, R_{sigma} = 0.0471]
Data/restraints/parameters	9374/42/729
Goodness-of-fit on F^2	1.054
Final R indexes [I>=2σ (I)]	R_1 = 0.0703, wR_2 = 0.1885
Final R indexes [all data]	R_1 = 0.0918, wR_2 = 0.2085
Largest diff. peak/hole / e Å^{-3}	1.16/-0.75
CCDC number	2294233

CheckCIF shows two B-level alerts for *m*-**HiCage·6Cl.**

PROBLEM: PLAT420_ALERT_2_B D-H Bond Without Acceptor O026--H026. Please Check.

RESPONSE: Here there is disorder in isopropyl alcohol and no hydrogen bond acceptors nearby.

PROBLEM: THETM01_ALERT_3_B The value of sine(theta_max)/wavelength is less than 0.575.

Calculated sin(theta_max)/wavelength = 0.5688.

RESPONSE: Weak absorption in high angle of the single crystal causes this problem.

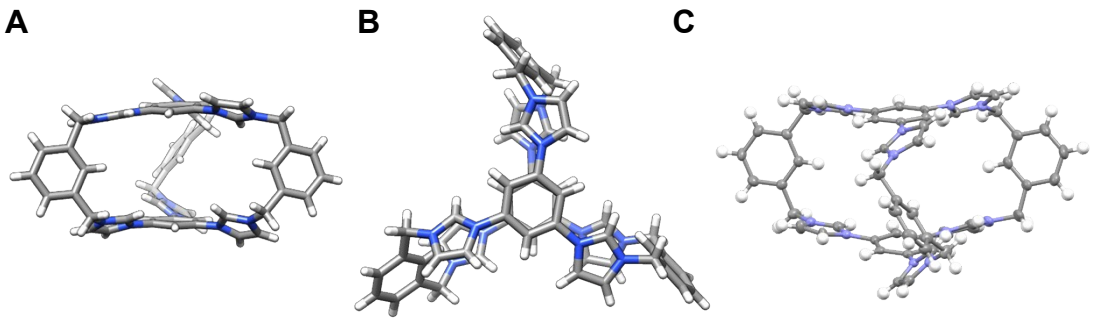


Figure S10. X-ray molecular structure of *m*-**HiCage·6Cl** with side (A) and top (B) views. (C) The molecules is depicted in stick-ellipsoid style at 50% probability level for all atoms. The other anions and all solvent molecules in a unit cell were omitted for clarity.

Table S8. Crystal data and structure refinement for *o*-**HiCage·6Cl.**

Empirical formula	$C_{54}H_{48}Cl_6N_{12}$
Formula weight	1077.74
Temperature/K	273
Crystal system	triclinic
Space group	P-1
a/Å	12.9419(12)
b/Å	15.2839(15)
c/Å	20.9548(18)
α/°	93.055(5)
β/°	98.472(5)
γ/°	108.395(5)
Volume/Å^3	3868.2(6)
Z	2
ρ_{calc}/g/cm^3	0.925
μ/mm^{-1}	2.296
F(000)	1116.0
Crystal size/mm^3	0.04 × 0.03 × 0.03
Radiation	Cu Kα (λ = 1.54178)
2Θ range for data collection/°	4.288 to 140.14

Index ranges	$-15 \le h \le 15, -18 \le k \le 18, -25 \le l \le 24$
Reflections collected	63339
Independent reflections	14366 [R_{int} = 0.1079, R_{sigma} = 0.0871]
Data/restraints/parameters	14366/37/649
Goodness-of-fit on F^2	1.226
Final R indexes [I>=2σ (I)]	R_1 = 0.1368, wR_2 = 0.2995
Final R indexes [all data]	R_1 = 0.2041, wR_2 = 0.3286
Largest diff. peak/hole / e $Å^{-3}$	1.24/-1.16
CCDC number	2294234

CheckCIF shows a B-level alert for *o*-**HiCage·6Cl.**

PROBLEM: PLAT340_ALERT_3_B Low Bond Precision on C-C Bonds. 0.01102 Ang.

RESPONSE: This is likely related to the weak diffraction of the crystal.

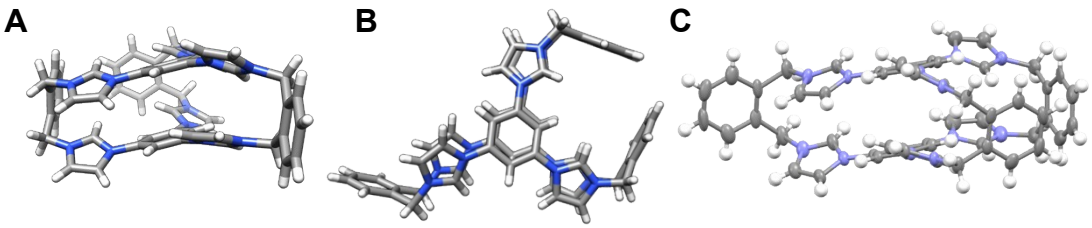


Figure S11. X-ray molecular structure of *o*-**HiCage·6Cl** with side (A) and top (B) views. (C) The molecules is depicted in stick-ellipsoid style at 50% probability level for all atoms. The other anions and all solvent molecules in a unit cell were omitted for clarity.

5. Physicochemical Properties of HiCage·6Cl

UV-vis absorption spectra was recorded with water as the solvent. The **ε** of **HiCage·6Cl** was determined by five concentrations of each compound (*p*-**HiCage·6Cl**: 2.032×10^{-3}, 4.065×10^{-3}, 6.097×10^{-3}, 8.129×10^{-3}, 1.016×10^{-2}, 1.219×10^{-2} mM; *m*-**HiCage·6Cl**: 2.041×10^{-3}, 4.083×10^{-3}, 6.124×10^{-3}, 8.165×10^{-3}, 1.021×10^{-2}, 1.225×10^{-2} mM; *o*-**HiCage·6Cl**: 2.062×10^{-3}, 4.124×10^{-3}, 6.186×10^{-3}, 8.248×10^{-3}, 1.031×10^{-2}, 1.237×10^{-2} mM). There was no obvious signal in the fluorescence spectrum. The temperature was 298 K.

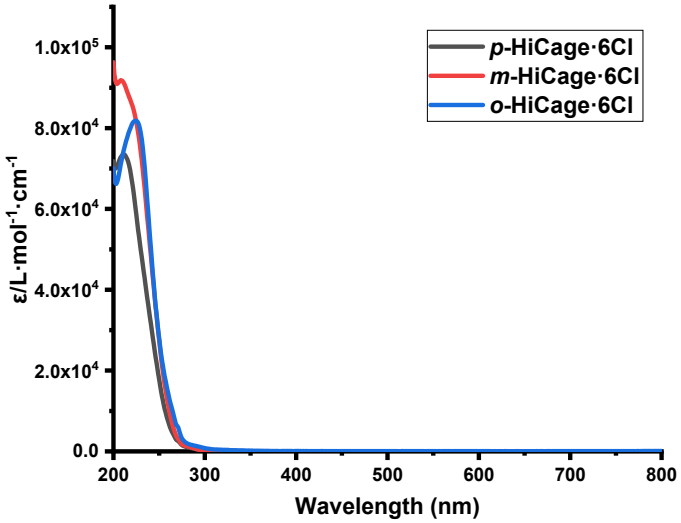


Figure S12. UV-vis Spectra of **HiCage·6Cl** from 200 to 800 nm.

6. UV-vis Titration of with HiCage·6Cl with UA

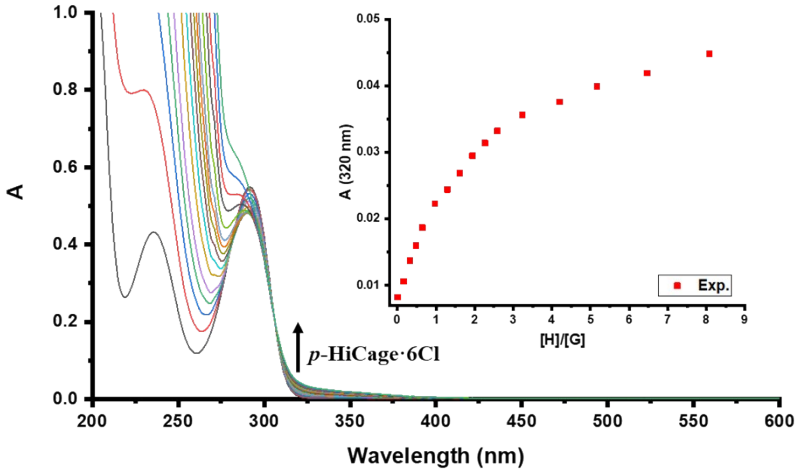


Figure S13. UV-vis titration spectra at 25 ºC of **UA** (4.595 × 10^{-2} mM) with addition of 0–8.08 equiv. of *p*-**HiCage·6Cl** in water. The inset show a plot of **A** (320 nm) against [*p*-**HiCage·6Cl**]/[**UA**].

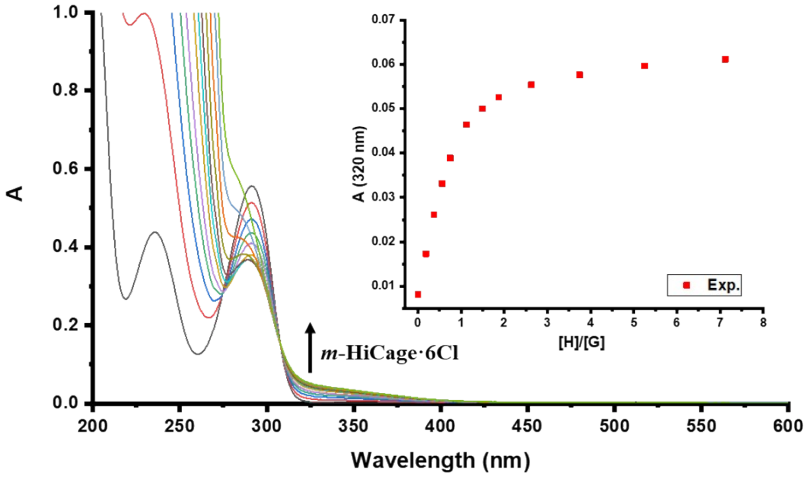


Figure S14. UV-vis titration spectra at 25 ºC of **UA** (4.657 × 10^{-2} mM) with addition of 0–7.12 equiv. of *m*-

HiCage·6Cl in water. The inset show a plot of **A** (320 nm) against [*m*-**HiCage·6Cl**]/[**UA**].

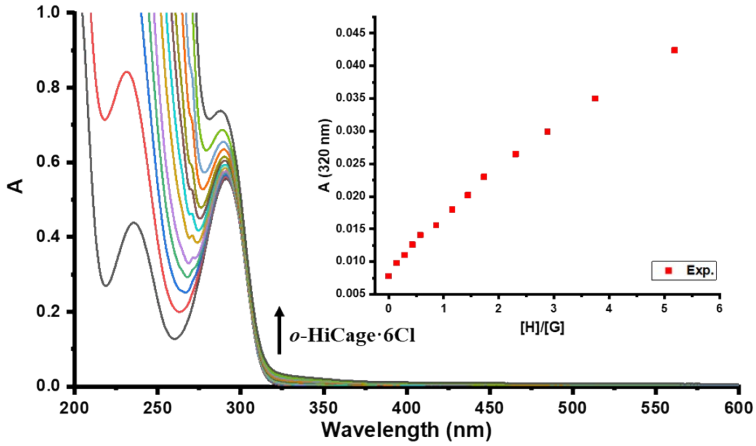


Figure S15. UV-vis titration spectra at 25 ºC of **UA** (4.657 × 10^{-2} mM) with addition of 0–5.18 equiv. of *o*-**HiCage·6Cl** in water. The inset show a plot of **A** (320 nm) against [*o*-**HiCage·6Cl**]/[**UA**].

7. ITC Titration of with HiCage·6Cl with Purines

Table S9. The thermodynamic parameters for the association of *p*-**HiCage·6Cl** or *m*-**HiCage·6Cl** with **Purines** via ITC in water at 25 °C.

Host	Guest	K_a (M^{-1})	$-\Delta H$ (kcal·mol^{-1})	$T\Delta S$ (kcal·mol^{-1})	$-\Delta G$ (kcal·mol^{-1})
p-**HiCage**	**UA**	(2.61 ± 0.06) × 10^4	1.23 ± 0.01	4.80	6.03
p-**HiCage**	**UA Na**	(1.94 ± 0.07) × 10^4	1.19 ± 0.02	4.66	5.85
m-**HiCage**	**UA**	(5.86 ± 0.30) × 10^4	3.03 ± 0.04	3.47	6.50
m-**HiCage**	**UA Na**	(4.32 ± 0.16) × 10^4	2.96 ± 0.03	3.36	6.32
Both	**Ade**	-[a]	-[a]	-[a]	-[a]
Both	**Caf**	-[a]	-[a]	-[a]	-[a]
Both	**HX**	-[a]	-[a]	-[a]	-[a]
Both	**Purine**	-[a]	-[a]	-[a]	-[a]

a. The heat effect for complexation was too small to fit.

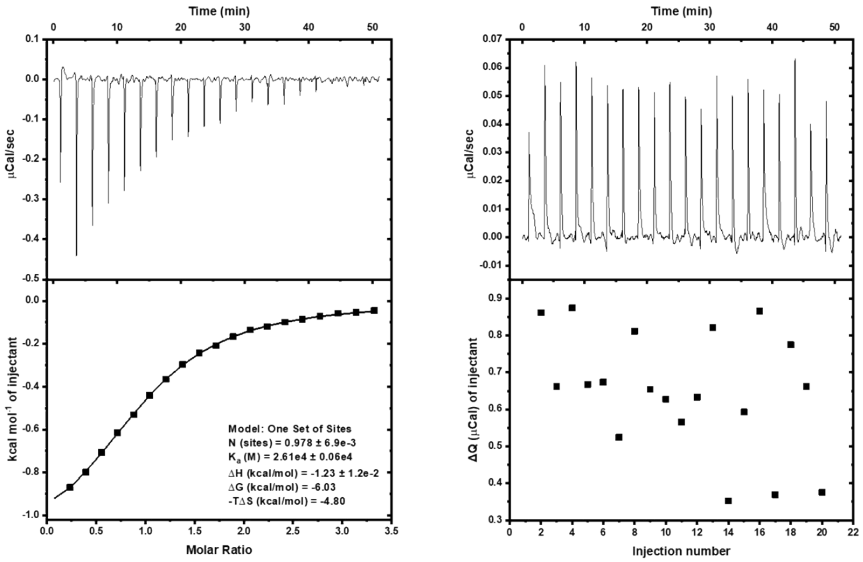


Figure S16. ITC titration of **UA** (0.1250 mM in 280 μL of water) upon the addition of *p*-**HiCage·6Cl** (The 1.998 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *p*-**HiCage·6Cl** (Same as above).

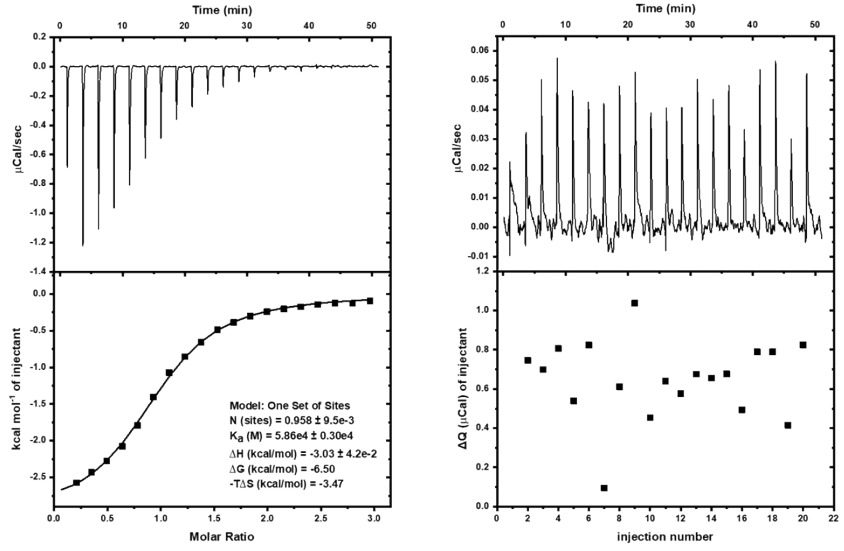


Figure S17. ITC titration of **UA** (0.1403 mM in 280 μL of water) upon the addition of *m*-**HiCage·6Cl** (The 1.994 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *m*-**HiCage·6Cl** (Same as above).

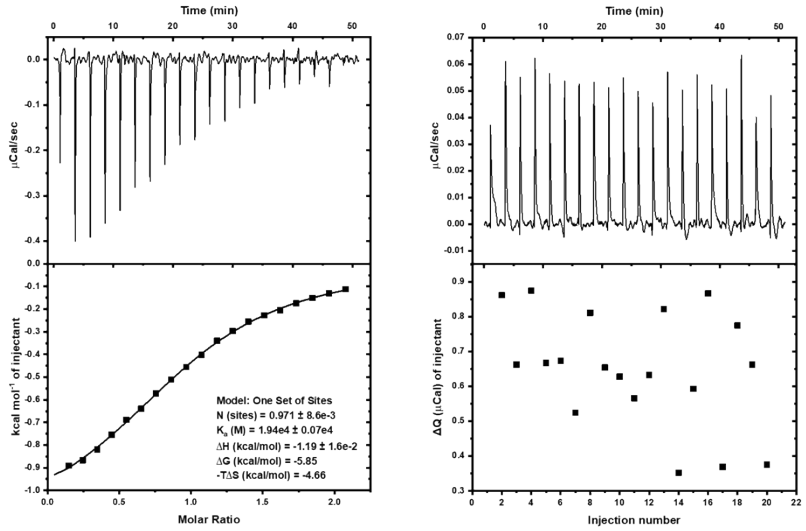


Figure S18. ITC titration of **UA Na** (0.2010 mM in 280 μL of water) upon the addition of *p*-**HiCage·6Cl** (The 1.998 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *p*-**HiCage·6Cl** (Same as above).

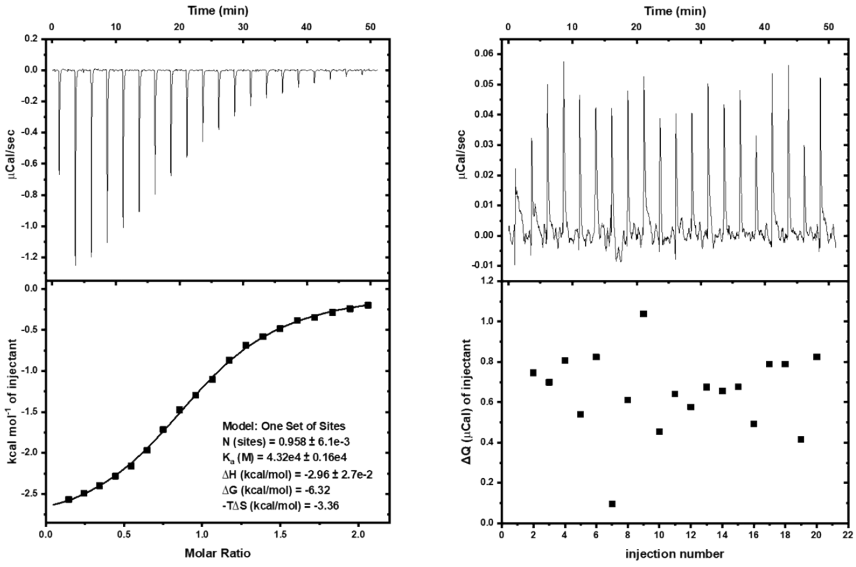


Figure S19. ITC titration of **UA Na** (0.2010 mM in 280 μL of water) upon the addition of *m*-**HiCage·6Cl** (The 1.994 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *m*-**HiCage·6Cl** (Same as above).

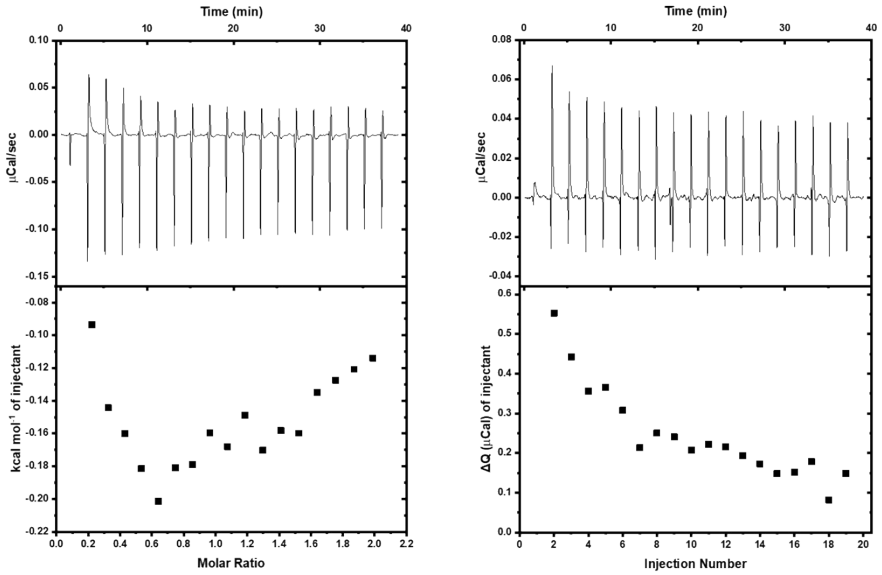


Figure S20. ITC titration of **Ade** (0.2111 mM in 280 μL of water) upon the addition of *p*-**HiCage·6Cl** (The 2.166 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *p*-**HiCage·6Cl** (Same as above).

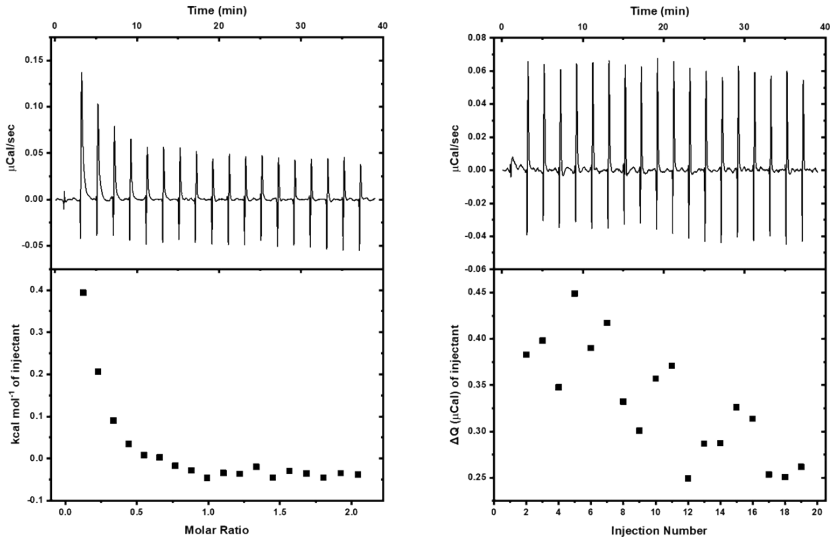


Figure S21. ITC titration of **Ade** (0.2111 mM in 280 μL of water) upon the addition of *m*-**HiCage·6Cl** (The 2.227 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *m*-**HiCage·6Cl** (Same as above).

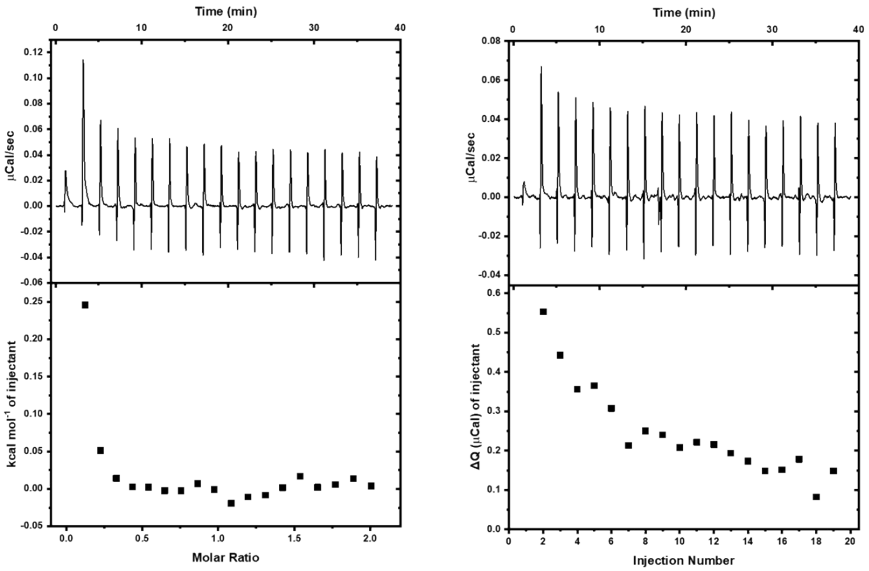


Figure S22. ITC titration of **Caf** (0.2086 mM in 280 μL of water) upon the addition of *p*-**HiCage·6Cl** (The 2.166 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *p*-**HiCage·6Cl** (Same as above).

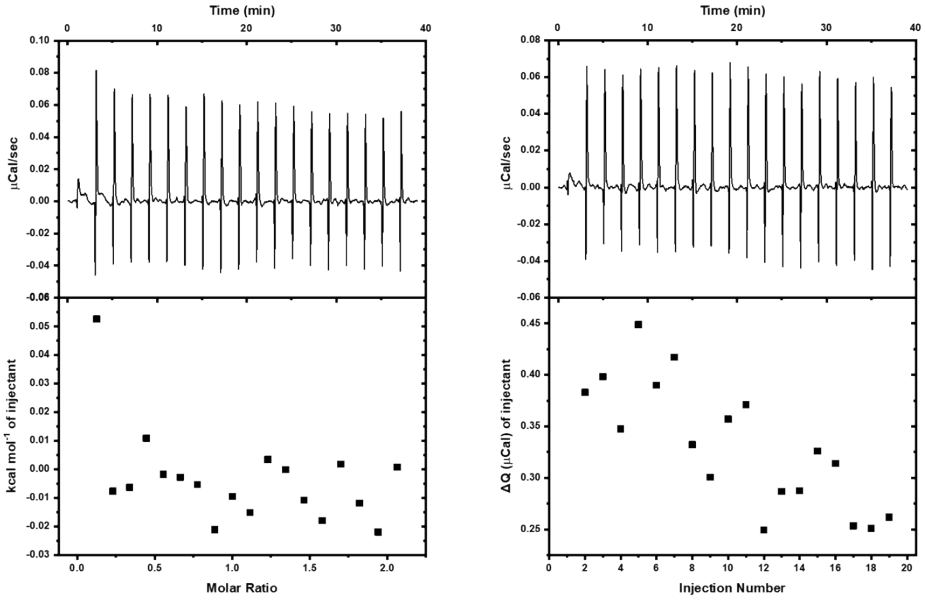


Figure S23. ITC titration of **Caf** (0.2086 mM in 280 μL of water) upon the addition of *m*-**HiCage·6Cl** (The 2.227 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *m*-**HiCage·6Cl** (Same as above).

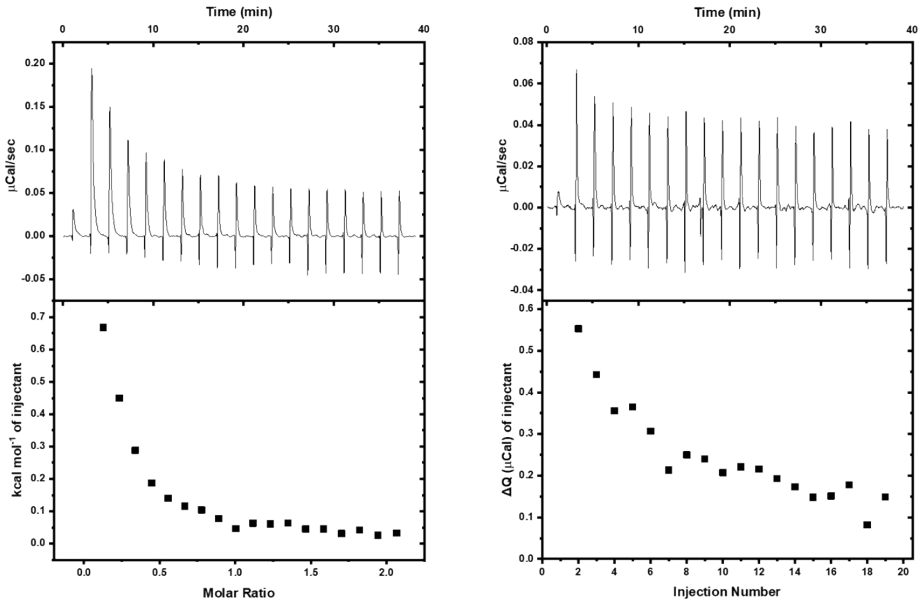


Figure S24. ITC titration of **HX** (0.2033 mM in 280 μL of water) upon the addition of *p*-**HiCage·6Cl** (The 2.166 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *p*-**HiCage·6Cl** (Same as above).

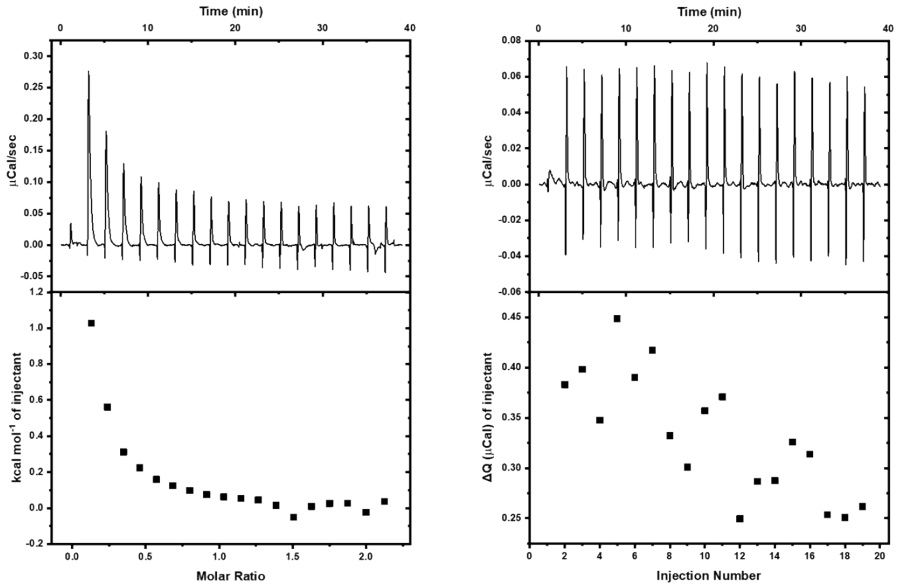


Figure S25. ITC titration of **HX** (0.2033 mM in 280 μL of water) upon the addition of *m*-**HiCage·6Cl** (The 2.227 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *m*-**HiCage·6Cl** (Same as above).

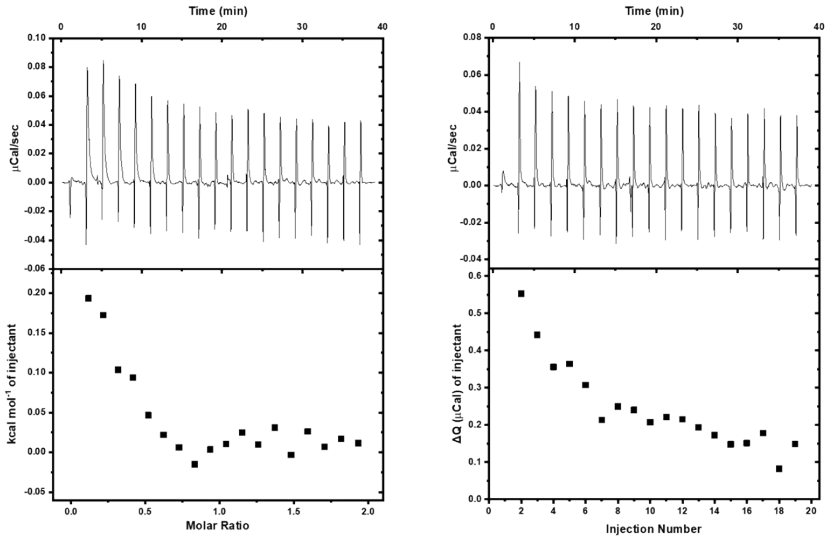


Figure S26. ITC titration of **Purine** (0.2164 mM in 280 μL of water) upon the addition of *p*-**HiCage·6Cl** (The 2.166 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *p*-**HiCage·6Cl** (Same as above).

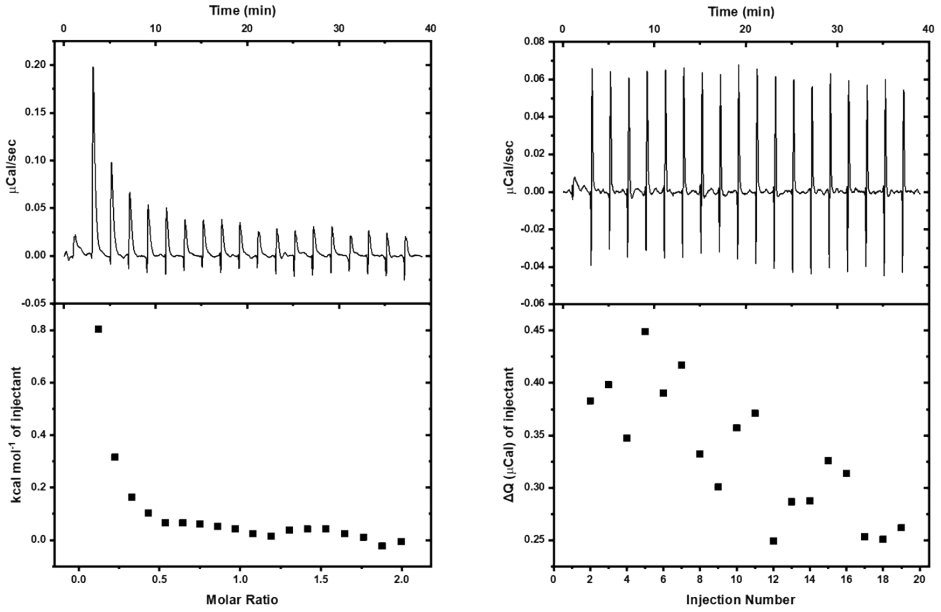


Figure S27. ITC titration of **Purine** (0.2164 mM in 280 μL of water) upon the addition of *m*-**HiCage·6Cl** (The 2.227 mM solution was divided into 19 drops, the first drop was 2 μL, the remaining 18 drops were 4 μL, and the data of the first drop was not collected); The right figure is water with addition of *m*-**HiCage·6Cl** (Same as above).

8. NMR Titration of with HiCage·6Cl with Purines

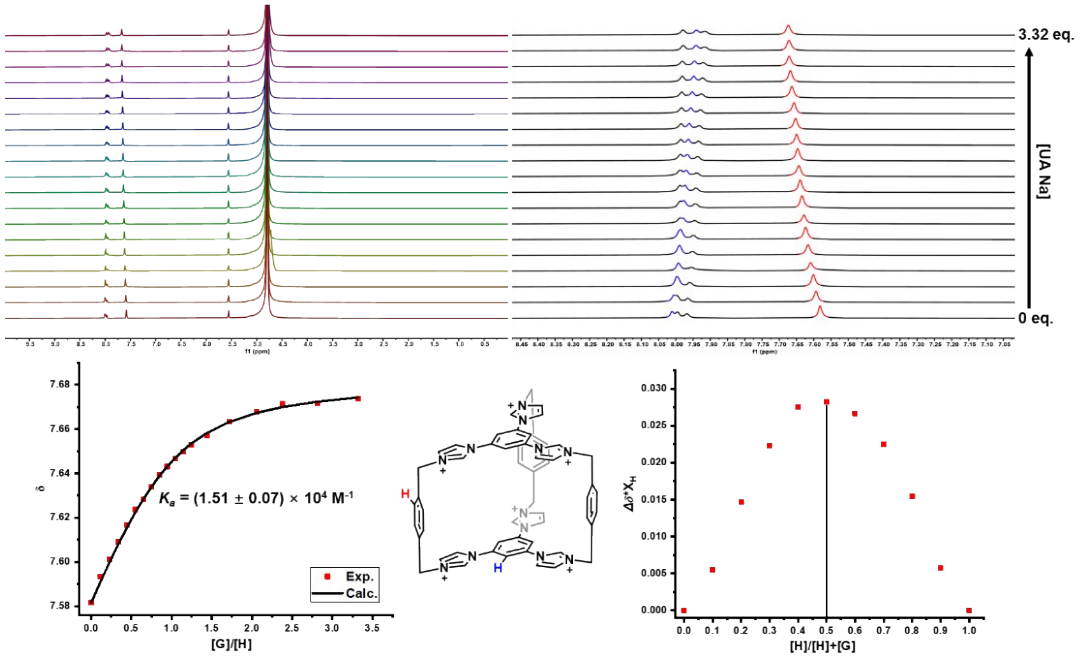


Figure S28 (Top) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *p*-**HiCage·6Cl** (0.3062 mM) and **UA Na** with variable concentrations (0 - 3.32 equiv.). The left is full spectra and the right is partial spectra. (Bottom) Plot of the chemical shift of *p*-**HiCage·6Cl** as a function of [G]/*p*-**HiCage·6Cl** (left) and Job's plot (right).

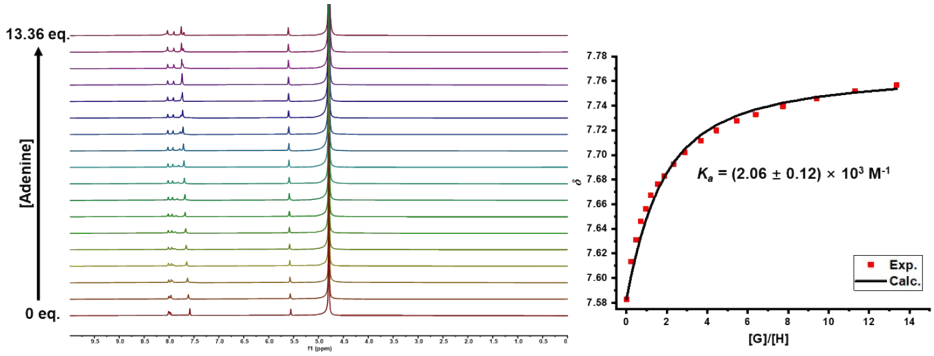


Figure S29 (Left) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *p*-**HiCage·6Cl** (0.4083 mM) and **Ade** with variable concentrations (0–13.36 equiv.). (Right) Plot of the chemical shift of *p*-**HiCage·6Cl** as a function of [G]/*p*-**HiCage·6Cl**.

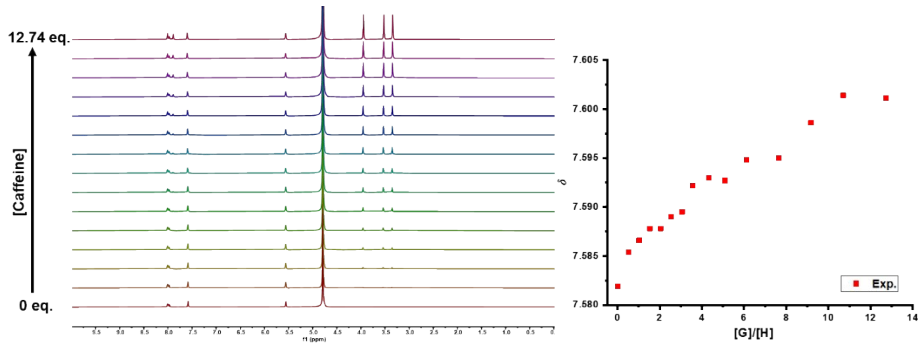


Figure S30 (Left) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *p*-**HiCage·6Cl** (0.4083 mM) and **Caf** with variable concentrations (0–12.74 equiv.). (Right) Plot of the chemical shift of *p*-**HiCage·6Cl** as a function of [G]/*p*-**HiCage·6Cl**.

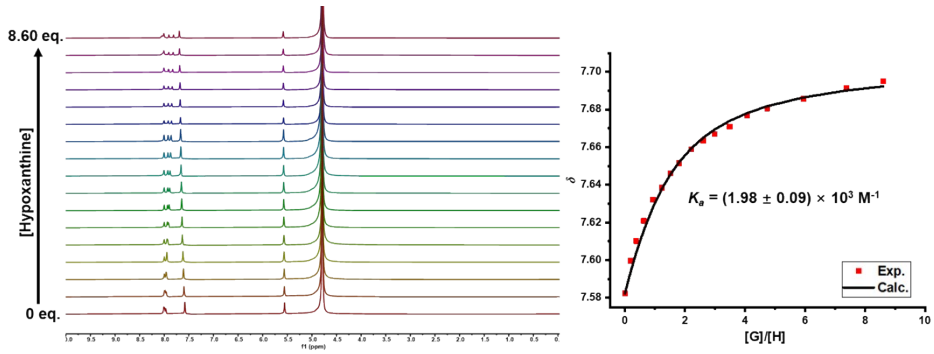


Figure S31 (Left) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *p*-**HiCage·6Cl** (0.4083 mM) and **HX** with variable concentrations (0–12.74 equiv.). (Right) Plot of the chemical shift of *p*-**HiCage·6Cl** as a function of [G]/*p*-**HiCage·6Cl**.

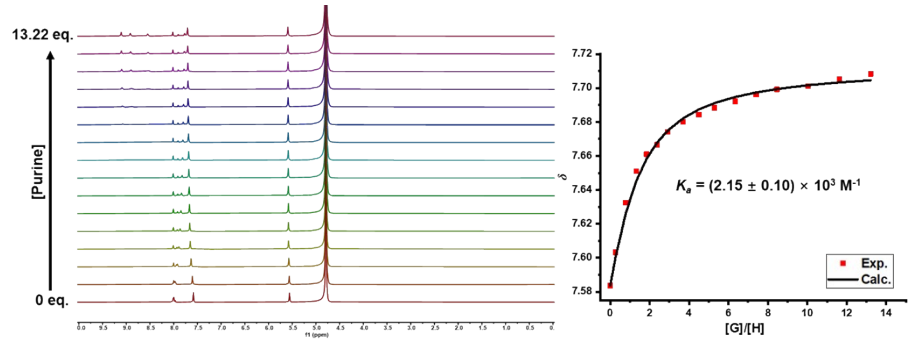


Figure S32 (Left) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *p*-**HiCage·6Cl** (0.4083 mM) and **Purine** with variable concentrations (0–13.22 equiv.). (Right) Plot of the chemical shift of *p*-**HiCage·6Cl** as a function of [G]/*p*-**HiCage·6Cl**.

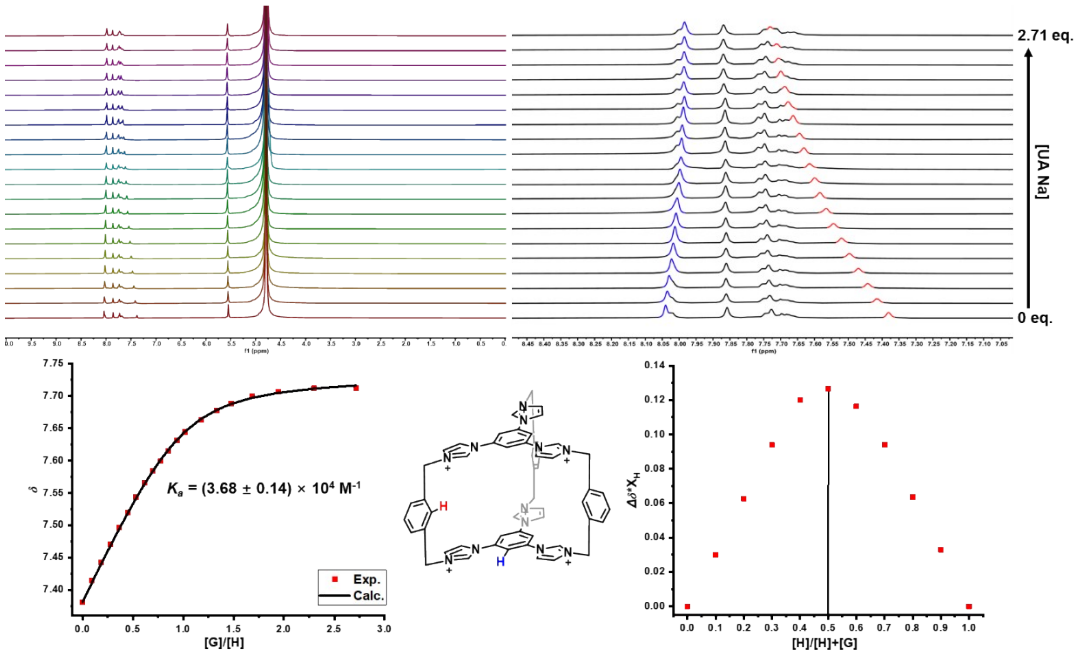


Figure S33 (Top) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *m*-**HiCage·6Cl** (0.3006 mM) and **UA Na** with variable concentrations (0–2.71 equiv.). The left is full spectra and the right is partial spectra. (Bottom) Plot of the chemical shift of *m*-**HiCage·6Cl** as a function of [G]/*m*-**HiCage·6Cl** (left) and Job's plot (right).

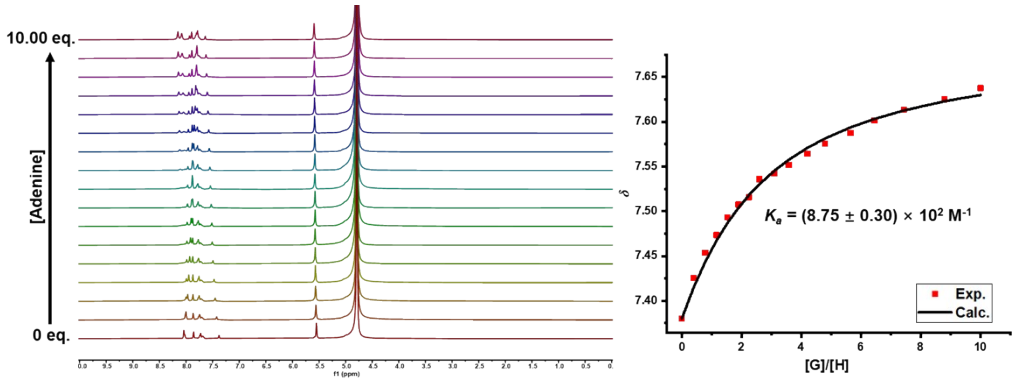


Figure S34 (Left) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *m*-**HiCage·6Cl** (0.5010 mM) and **Ade** with variable concentrations (0–10.00 equiv.). (Right) Plot of the chemical shift of *m*-**HiCage·6Cl** as a function of [G]/*m*-**HiCage·6Cl**.

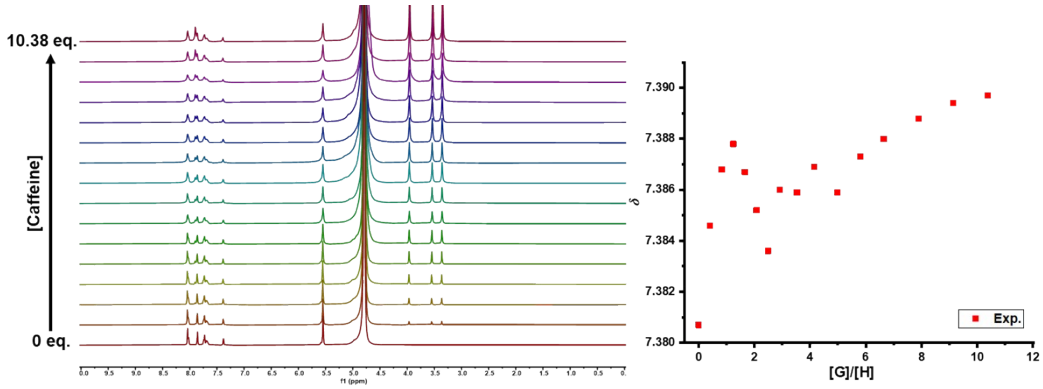


Figure S35 (Left) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *m*-**HiCage·6Cl**

(0.5010 mM) and **Caf** with variable concentrations (0–10.38 equiv.). (Right) Plot of the chemical shift of *m*-**HiCage·6Cl** as a function of [G]/*m*-**HiCage·6Cl**.

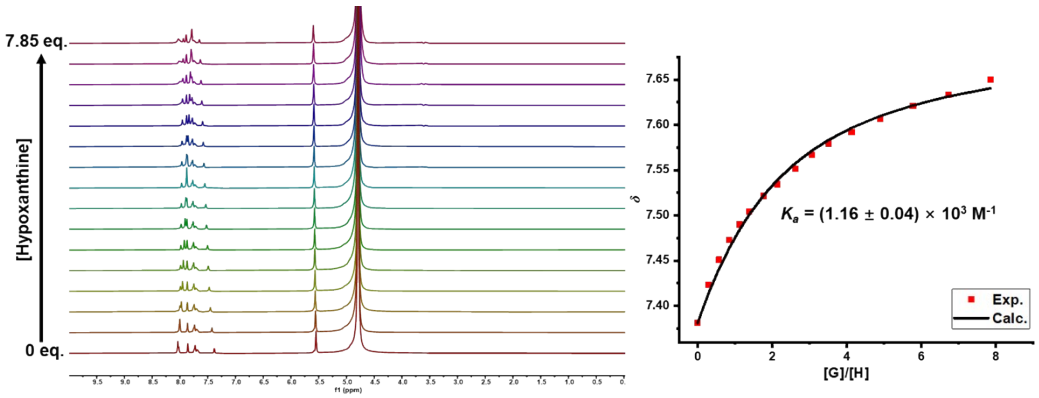


Figure S36 (Left) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *m*-**HiCage·6Cl** (0.5010 mM) and **HX** with variable concentrations (0–7.85 equiv.). (Right) Plot of the chemical shift of *m*-**HiCage·6Cl** as a function of [G]/*m*-**HiCage·6Cl**.

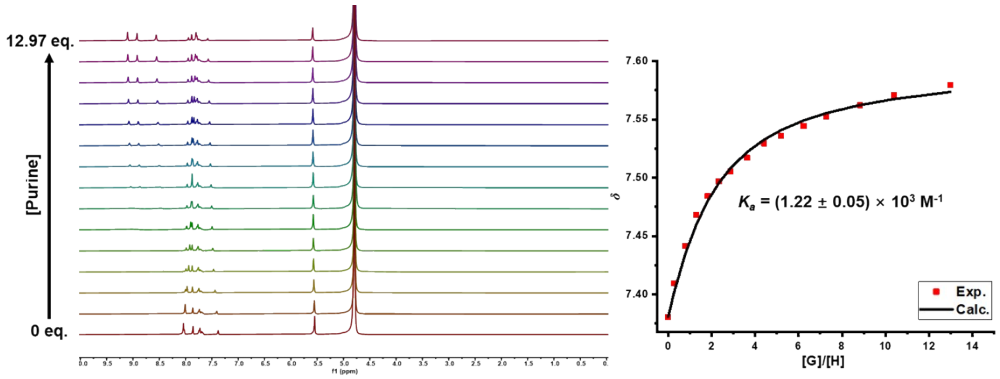


Figure S37 (Left) ^{1}H NMR titration spectra (400 MHz, D_2O, 25 °C,) recorded for a solution of *m*-**HiCage·6Cl** (0.5010 mM) and **Purine** with variable concentrations (0–12.97 equiv.). (Right) Plot of the chemical shift of *m*-**HiCage·6Cl** as a function of [G]/*m*-**HiCage·6Cl**.

9. HRMS of Host-Guest Complexes of HiCage and UA

Table S10. HRMS of Complexes of **HiCage** and **UA**

Complex	Calcd. (m/z)	Found (m/z)
[*p*-**HiCage·2PF$_6$** + **UA** – 2H]$^{2+}$	660.1762	660.1761
[*p*-**HiCage·Cl** + **UA** – 3H]$^{2+}$	532.1926	532.1928
[*m*-**HiCage·PF$_6$** + **UA** – 3H]$^{2+}$	587.1902	587.1904
[*m*-**HiCage·Cl** + **UA** – 3H]$^{2+}$	532.1926	532.1924

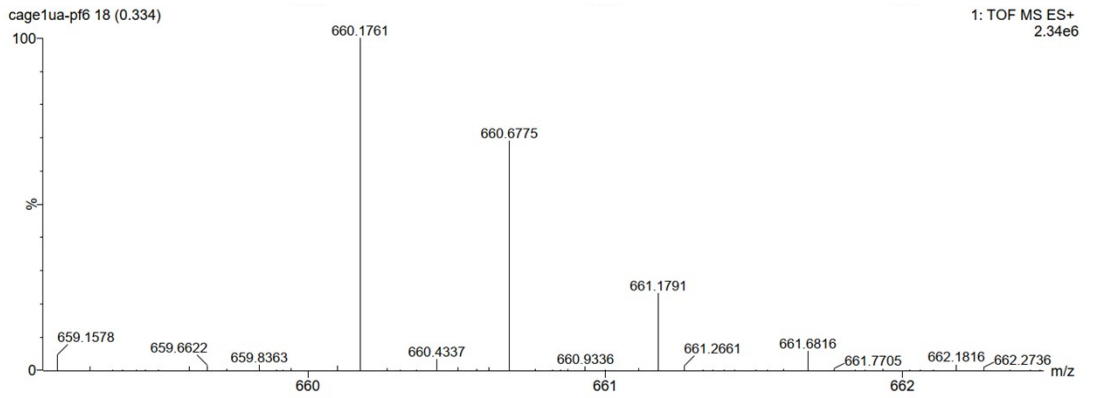


Figure S38. HRMS (ESI) of a mixture of *p*-**HiCage·6PF$_6$** and **UA**.

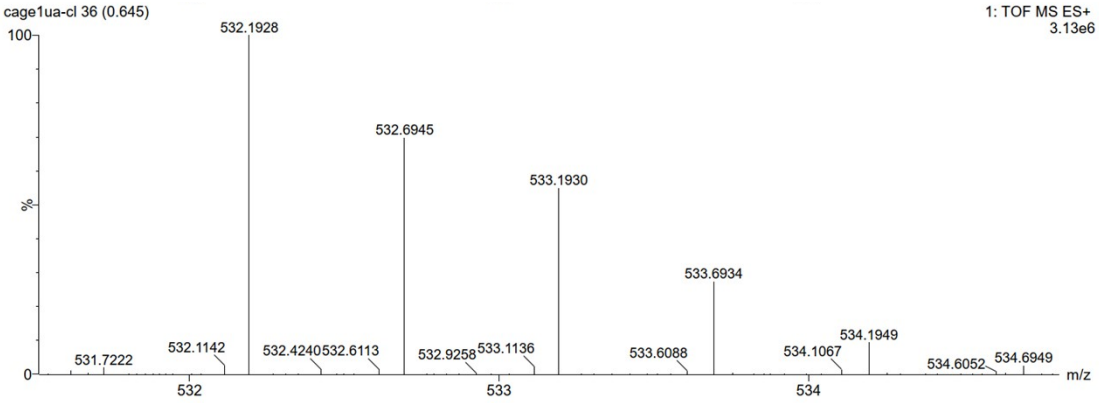


Figure S39. HRMS (ESI) of a mixture of *p*-**HiCage·6Cl** and **UA**.

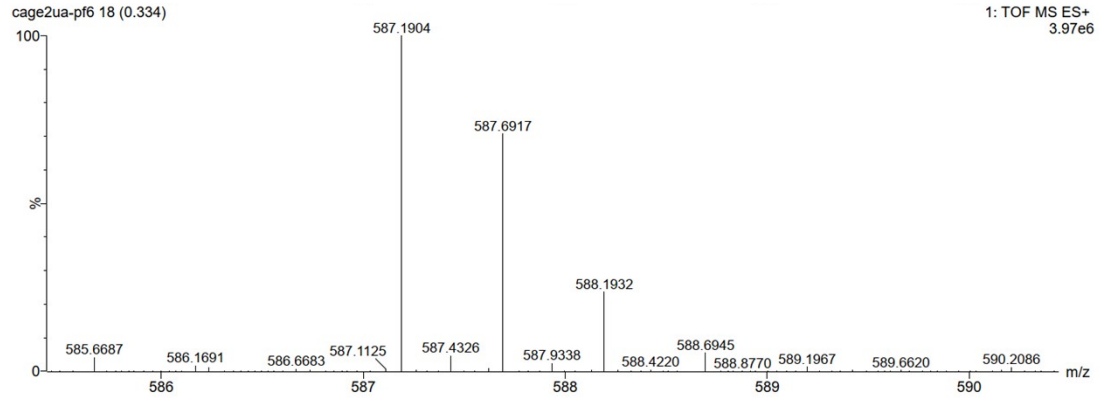


Figure S40. HRMS (ESI) of a mixture of *m*-**HiCage·6PF$_6$** and **UA**.

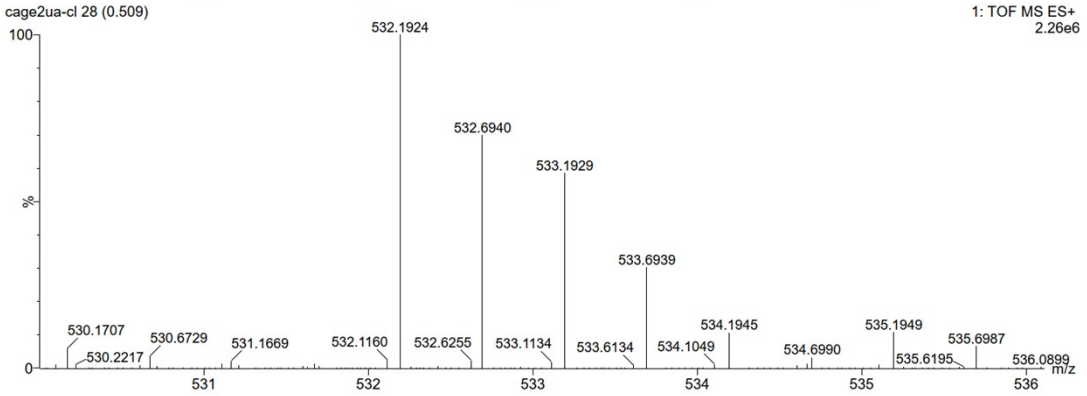


Figure S41. HRMS (ESI) of a mixture of *m*-**HiCage·6Cl** and **UA**.

10. Crystal Data and X-Ray Molecular Structures of Complexes

High-quality single crystals of **UA Na⊂*m*-HiCage·6Cl** and **pyrene⊂*p*-HiCage·6PF$_6$** were obtained by diffusion of methanol or ether into the aqueous solution of *m*-**HiCage·6Cl** with **UA Na**, acetonitrile solution of *p*-**HiCage·6PF$_6$** with pyrene. Single crystals of **UA Na⊂*p*-HiCage·6Cl** were obtained by diffusion of 1,4-dioxane into the aqueous solution of *p*-**HiCage·6Cl** with **UA Na**.

Crystal data and X-ray complex structures with their CCDC numbers are reported as follows. CIFs and CheckCIFs are provided in separated files as Supplementary Information. Following each Table of crystal data and structure refinement for compounds, we also provide explanations for any A-level alerts in the CheckCIF output.[2-3]

Table S11. Crystal data and structure refinement for complex of **UA Na⊂*m*-HiCage·6Cl**.

Empirical formula	$C_{59}H_{51}Cl_5N_{16}O_3$
Formula weight	1209.41
Temperature/K	273
Crystal system	triclinic
Space group	P-1
a/Å	13.0417(9)
b/Å	18.1648(12)
c/Å	19.7566(14)
α/°	108.285(4)
β/°	102.532(5)
γ/°	94.231(4)

Volume/Å^3	4287.0(5)
Z	2
ρ_{calc}/g/cm^3	0.937
μ/mm^{-1}	1.876
F(000)	1252.0
Crystal size/mm^3	0.02 × 0.02 × 0.01
Radiation	Cu Kα (λ = 1.54178)
2Θ range for data collection/°	5.184 to 118.61
Index ranges	-14 ≤ h ≤ 14, -20 ≤ k ≤ 17, -21 ≤ l ≤ 21
Reflections collected	33520
Independent reflections	12214 [R_{int} = 0.0711, R_{sigma} = 0.0856]
Data/restraints/parameters	12214/0/785
Goodness-of-fit on F^2	1.029
Final R indexes [I>=2σ (I)]	R_1 = 0.1031, wR_2 = 0.2983
Final R indexes [all data]	R_1 = 0.1453, wR_2 = 0.3357
Largest diff. peak/hole / e Å^{-3}	1.27/-0.38
CCDC number	2294236

CheckCIF shows a B-level alert for **UA Na⊂*m*-HiCage·6Cl.**

PROBLEM: THETM01_ALERT_3_B The value of sine(theta_max)/wavelength is less than 0.575.

Calculated sin(theta_max)/wavelength = 0.5577.

RESPONSE: Weak absorption in high angle of the single crystal causes this problem.

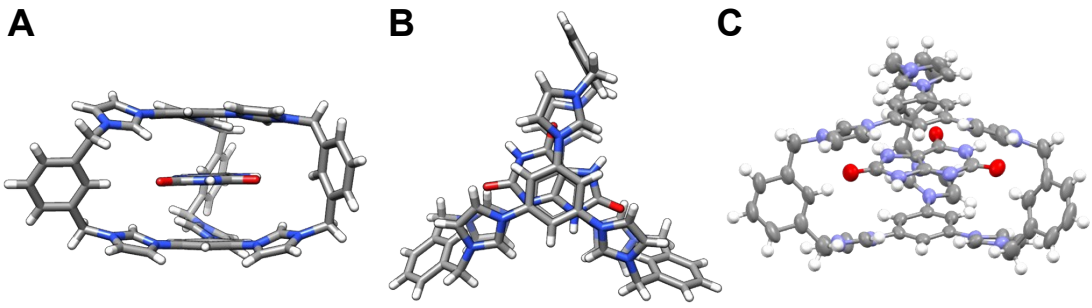


Figure S42. X-ray complex structure of **UA Na⊂*m*-HiCage·6Cl** with side (A) and top (B) views. (C) The molecules is depicted in stick-ellipsoid style at 50% probability level for all atoms. The other anions and all solvent molecules in a unit cell were omitted for clarity.

Table S12. Crystal data and structure refinement for complex of **UA Na⊂*p*-HiCage·6Cl**.

Empirical formula	$C_{221}H_{195}Cl_{23}N_{52}O_3$
Formula weight	4442.63
Temperature/K	173
Crystal system	triclinic
Space group	P-1
a/Å	19.556(2)
b/Å	20.524(2)
c/Å	21.612(2)
α/°	85.958(4)
β/°	89.024(4)
γ/°	68.616(4)
Volume/Å^3	8056.7(15)
Z	1
ρ_{calc}/g/cm^3	0.916
μ/mm^{-1}	1.424
F(000)	2300
Crystal size/mm^3	0.3 × 0.2 × 0.02
Radiation	Ca Kα (λ = 1.34139)
2Θ range for data collection/°	5.552 to 100
Index ranges	-22 ≤ h ≤ 20, -23 ≤ k ≤ 23, -23 ≤ l ≤ 24
Reflections collected	37972
Independent reflections	23836 [R_{int} = 0.0664, R_{sigma} = 0.0855]
Data/restraints/parameters	23836/135/1414
Goodness-of-fit on F^2	0.998
Final R indexes [I>=2σ (I)]	R_1 = 0.1407, wR_2 = 0.2981
Final R indexes [all data]	R_1 = 0.1758, wR_2 = 0.3172
Largest diff. peak/hole / e Å^{-3}	1.59/-0.87
CCDC number	2297784

CheckCIF shows five B-level alerts for **UA Na⊂*p*-HiCage·6Cl.**

PROBLEM: THETM01_ALERT_3_B The value of sine(theta_max)/wavelength is less than 0.575.

Calculated sin(theta_max)/wavelength = 0.5711.

RESPONSE: Weak absorption in high angle of the single crystal causes this problem.

PROBLEM: PLAT029_ALERT_3_B diffrn measured fraction theta full value Low. 0.948 Why?

RESPONSE: The crystal quality is poor. Severe polycrystallinity and disorder lead to missing data points at some angles, resulting in low data completeness.

PROBLEM: PLAT260_ALERT_2_B Large Average Ueq of Residue Including Cl7 0.457 Check

PLAT260_ALERT_2_B Large Average Ueq of Residue Including Cl8 0.365 Check

RESPONSE: Severe polycrystallinity and disorder in this crystal leading to weak diffraction, further causes this problem.

PROBLEM: PLAT340_ALERT_3_B Low Bond Precision on C-C Bonds. 0.01246 Ang.

RESPONSE: This is likely related to the weak diffraction of the crystal.

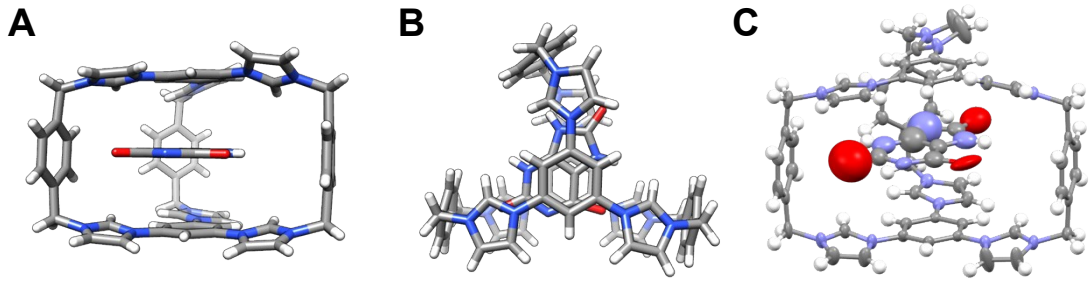


Figure S43. X-ray complex structure of **UA Na⊂*p*-HiCage·6Cl** with side (A) and top (B) views. (C) The molecules is depicted in stick-ellipsoid style at 50% probability level for all atoms. The other anions and all solvent molecules in a unit cell were omitted for clarity.

Table S13. Crystal data and structure refinement for complex of **pyrene⊂*p*-HiCage·6PF$_6$**.

Empirical formula	$C_{78}H_{70}F_{36}N_{16}P_6$
Formula weight	2101.32
Temperature/K	175
Crystal system	monoclinic
Space group	$P2_1/m$
a/Å	14.7282(4)
b/Å	20.4680(6)
c/Å	15.7127(4)
α/°	90

β/°	101.6720(10)
γ/°	90
Volume/Å^3	4638.8(2)
Z	2
ρ_{calc}/g/cm^3	1.504
μ/mm^{-1}	1.418
F(000)	2128.0
Crystal size/mm^3	0.1 × 0.05 × 0.03
Radiation	Ga Kα (λ = 1.34138)
2Θ range for data collection/°	8.852 to 109.996
Index ranges	-17 ≤ h ≤ 17, -24 ≤ k ≤ 24, -18 ≤ l ≤ 19
Reflections collected	69033
Independent reflections	9072 [R_{int} = 0.0537, R_{sigma} = 0.0291]
Data/restraints/parameters	9072/0/676
Goodness-of-fit on F^2	1.028
Final R indexes [I>=2σ (I)]	R_1 = 0.0474, wR_2 = 0.1468
Final R indexes [all data]	R_1 = 0.0574, wR_2 = 0.1559
Largest diff. peak/hole / e Å^{-3}	0.59/-0.32
CCDC number	2294235

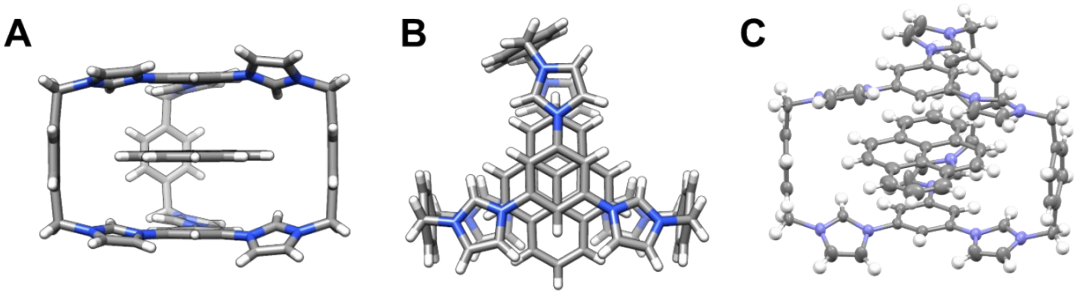


Figure S44. X-ray complex structure of **pyrene⊂*p*-HiCage·6PF$_6$** with side (A) and top (B) views. (C) The molecules is depicted in stick-ellipsoid style at 50% probability level for all atoms. The other anions and all solvent molecules in a unit cell were omitted for clarity.

11. Biosafety Assay

Cell cytotoxicity. Cytotoxicity was evaluated by cell counting kit-8 (CCK-8) assay. H9C2 cells and L02 cells were seeded in 96-well plate (~10^4 cells and 200 μL culture medium in per well) and were incubated for 24 hours at 310 K containing 5% CO_2. Then the culture medium was removed and 200 μL culture medium containing ***p*-HiCage·6Cl** or ***m*-HiCage·6Cl** at different concentration was added (60 - 180 μg/mL). The culture was removed after 24 h and 200 μL fresh culture medium containing 10% CCK-8 was added. The cells were incubated for another 1 hour and the cell cell survival rate was evaluated by absorbance at 450 nm and 600 nm using Allsheng AMR-100 microplate reader.

Hemolysis experiment. Human red blood cells were made by centrifuging from human whole blood in a 3000 r/min centrifuge for 15 min and then diluted to 5%. Rat red blood cells preserved in Alsever's solution (5%) were centrifuged in a 1000 r/min centrifuge for 10 min to obtain red blood cells. Cells were diluted with equal volume of isotonic saline. The mixed solution (140 μL) were mixed with saline (560 μL, negative control), deionized water (560 μL, positive control), ***p*-HiCage·6Cl** or ***m*-HiCage·6Cl** solution at different concentrations (60 - 180 μg/mL). After incubation for 1 h at 310 K, the samples were centrifugated at 10000 r/min for 10 min at 277 K and the supernatants were obtained, and their hemolysis ratio was evaluated by absorbance at 545 nm using Biotek Synergy H1 microplate reader.

12. Solubility Enhancement Studies of UA

Solubility enhancement studies were carried out using the phase solubility method.[4] Excess **UA** was dispersed in ***p*-HiCage·6Cl** (1 mM) and ***m*-HiCage·6Cl** (1 mM) in water, and the mixture was stired at room temperature for 24 h. After reaching equilibrium, the mixture was filtered through a 0.45 μm filter. The resulting filtrate was diluted to 50% and the concentration of **UA** was determined by HPLC under the following conditions: a mobile phase of 5% CH_3CN and 95% H_2O containing 0.1% TFA, a flow rate of 1.0 ml/min and a detection of 292 nm at 30 °C

Table S14. Solubility enhancement of **UA**

Host	S_{peak} (mAU*s) (50%)	C_{UA} (mM)	Enhancement rate
***p*-HiCage·6Cl** (1 mM)	2992	0.5011	1.26
***m*-HiCage·6Cl** (1 mM)	3336	0.5587	1.41
-	2358	0.3968	1

13. References

[1] A. Rit, T. Pape, and F. Ekkehardt Hahn, *J. Am. Chem. Soc.* **2010**, *132*, 4572.

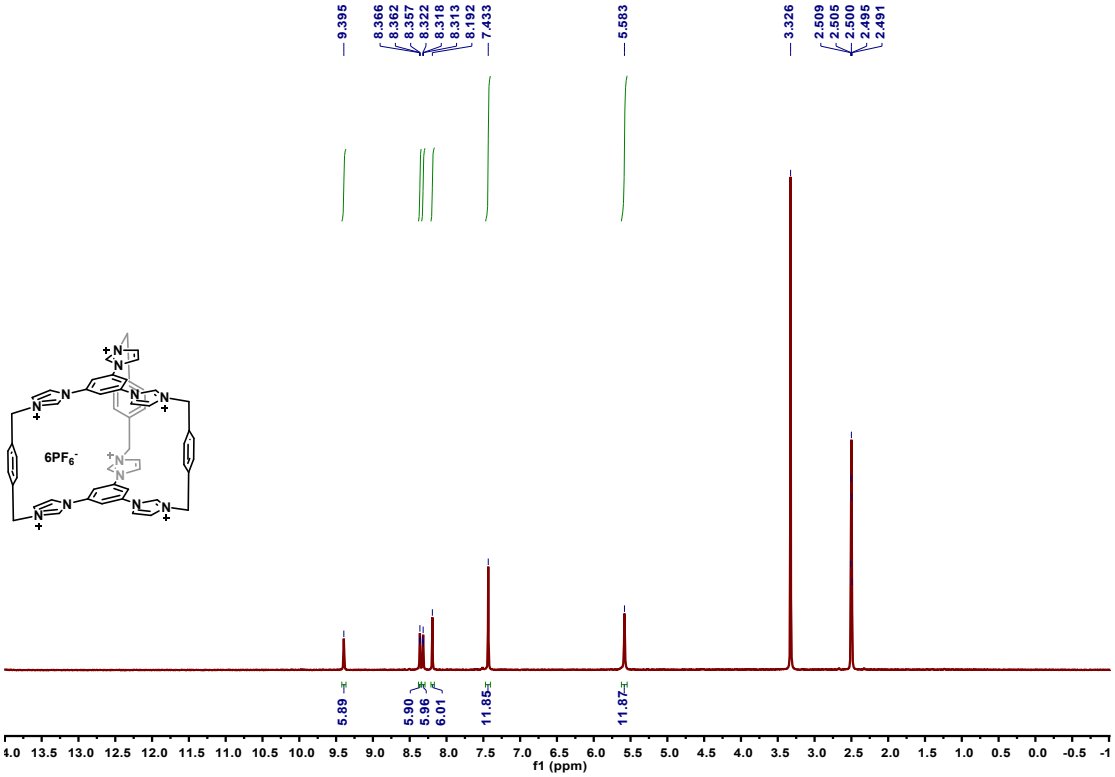
[2] O. V. Dolomanov, L. J. Bourhis, , R. J. Gildea, , J. A. K. Howard, , H. J. Puschmann, *Appl. Cryst.* **2009**. *42*, 339.

[3] G. M. Sheldrick, *Acta Cryst.* **2015**, *C71*, 3-8.

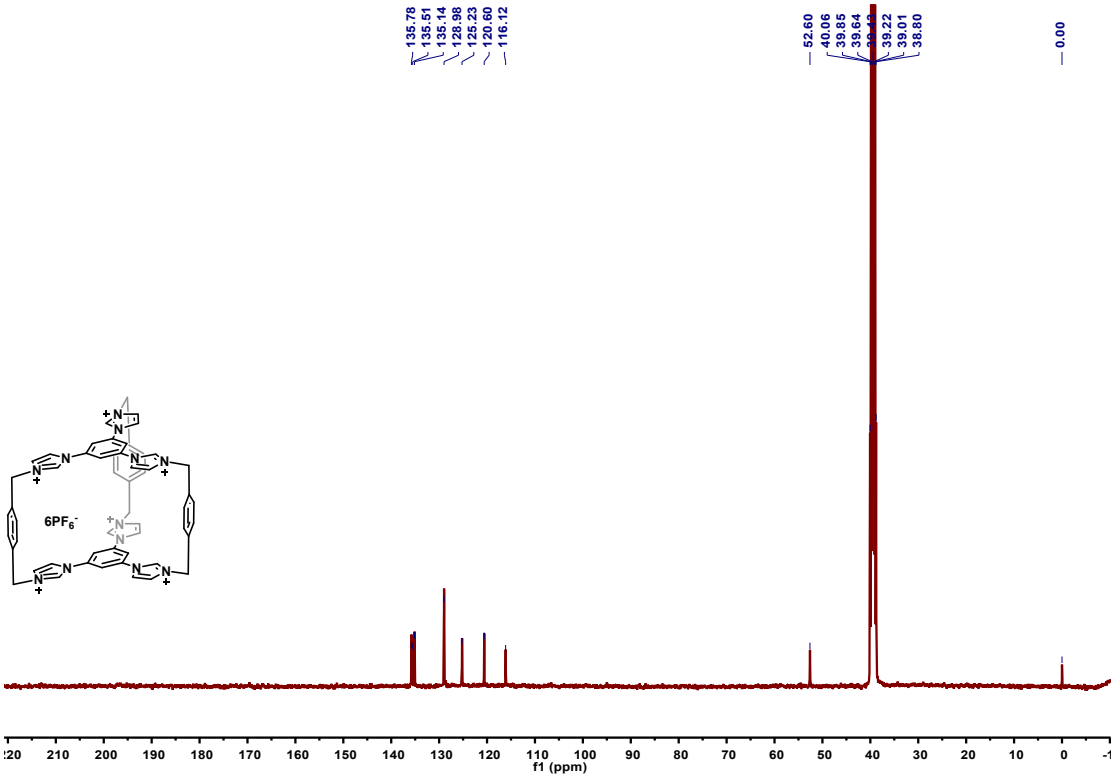
[4] *Binding Constants*. K. A. Connors, Wiley, **1987**.

14. Copies of ^{1}H and ^{13}C NMR Spectra

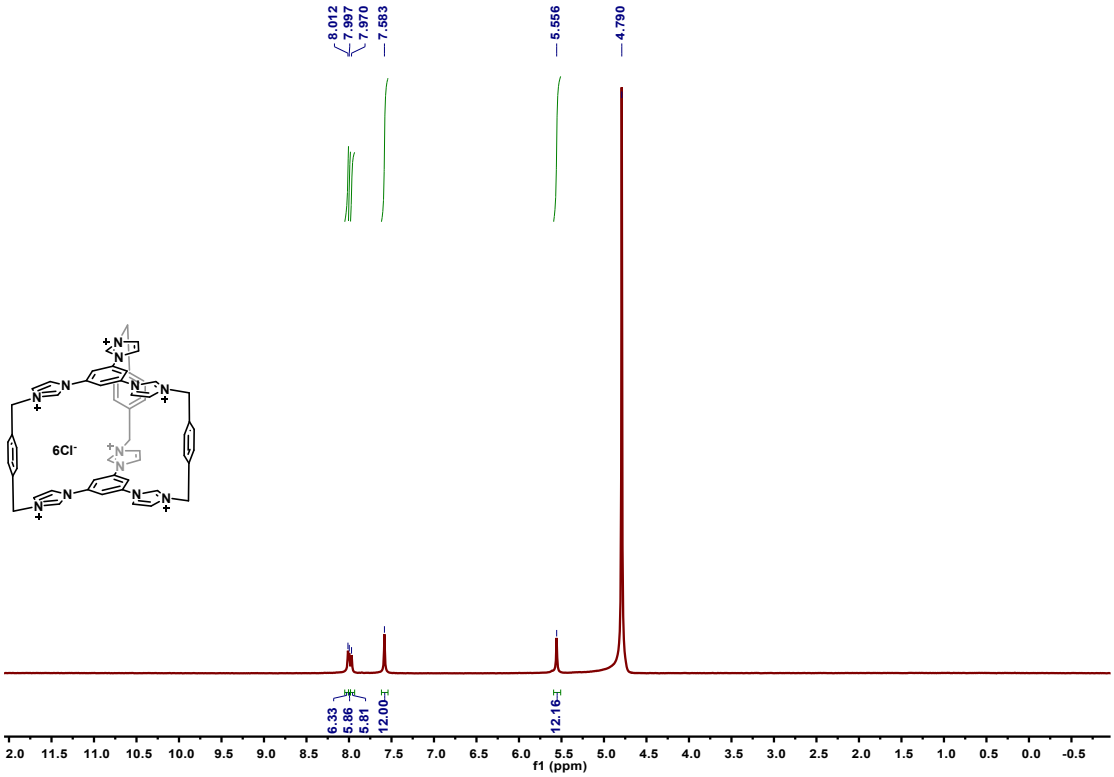
^{1}H NMR spectra of *p*-HiCage·6PF_6



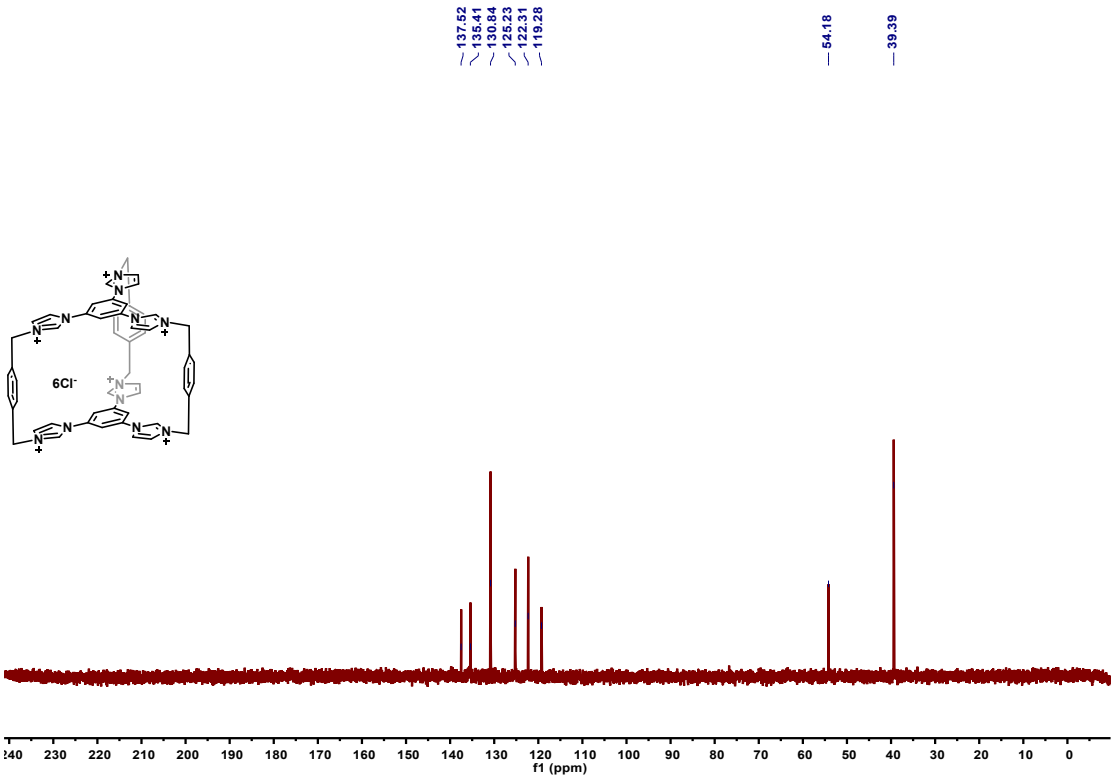
^{13}C NMR spectra of *p*-HiCage·6PF_6



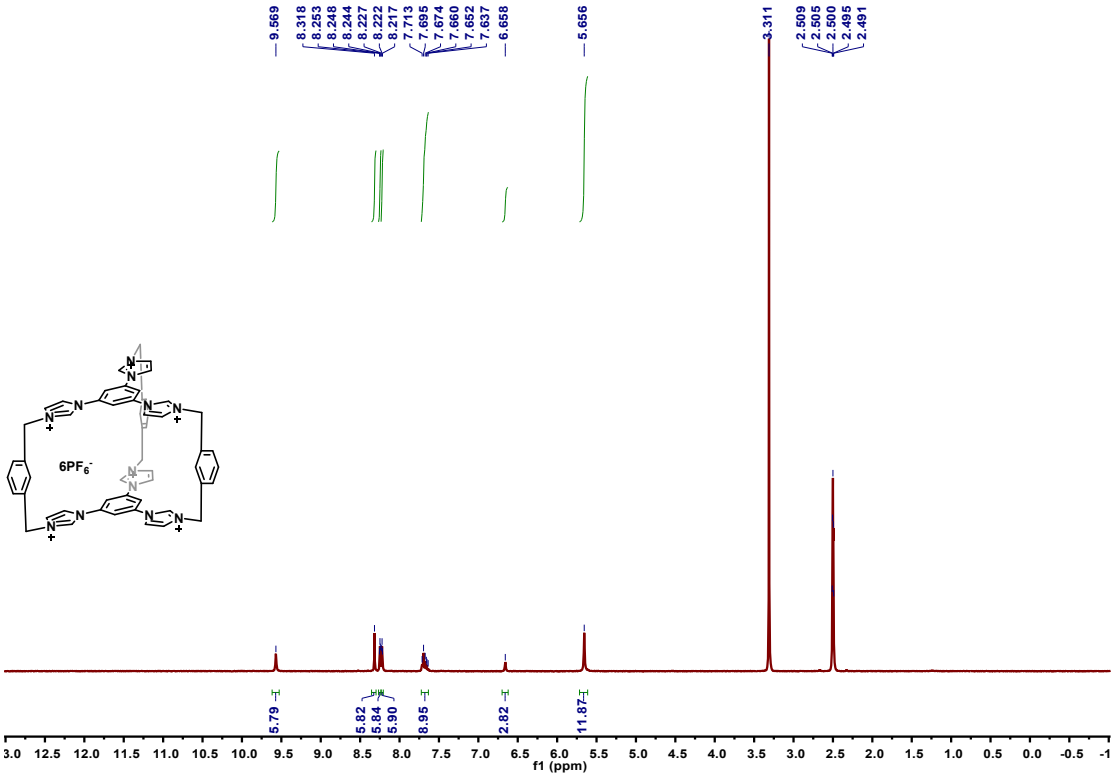
^{1}H NMR spectra of *p*-HiCage·6Cl



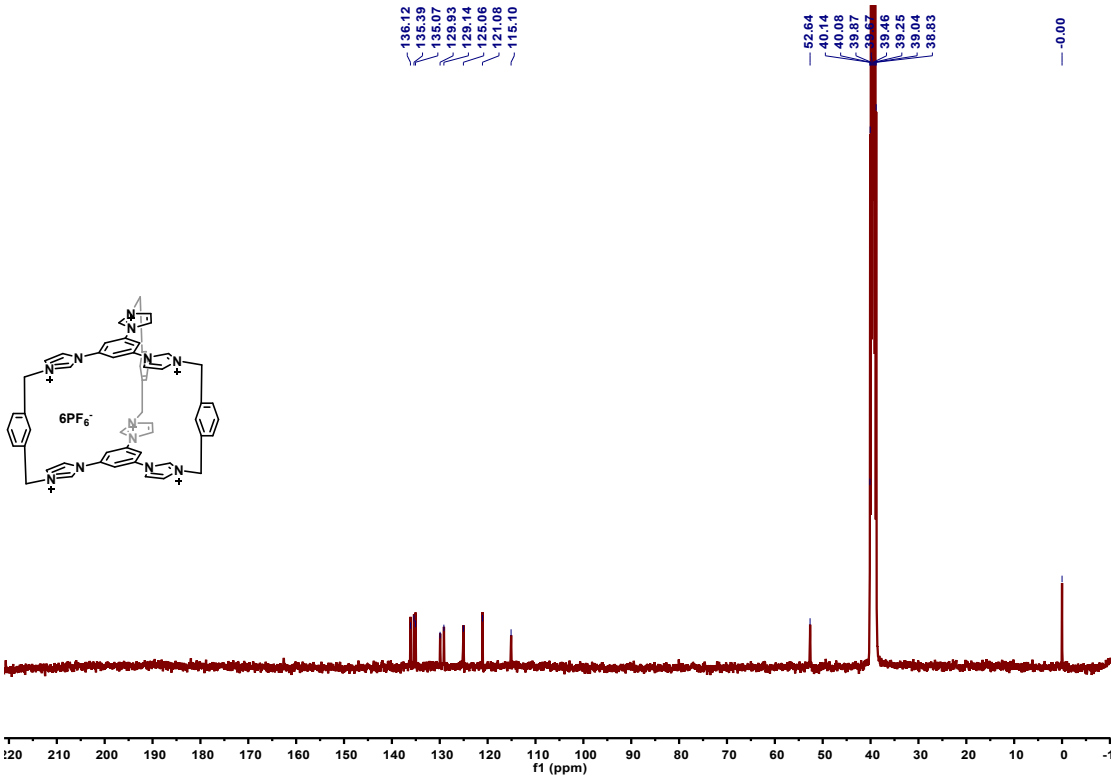
^{13}C NMR spectra of *p*-HiCage·6Cl with DMSO as internal reference (δ 39.4)



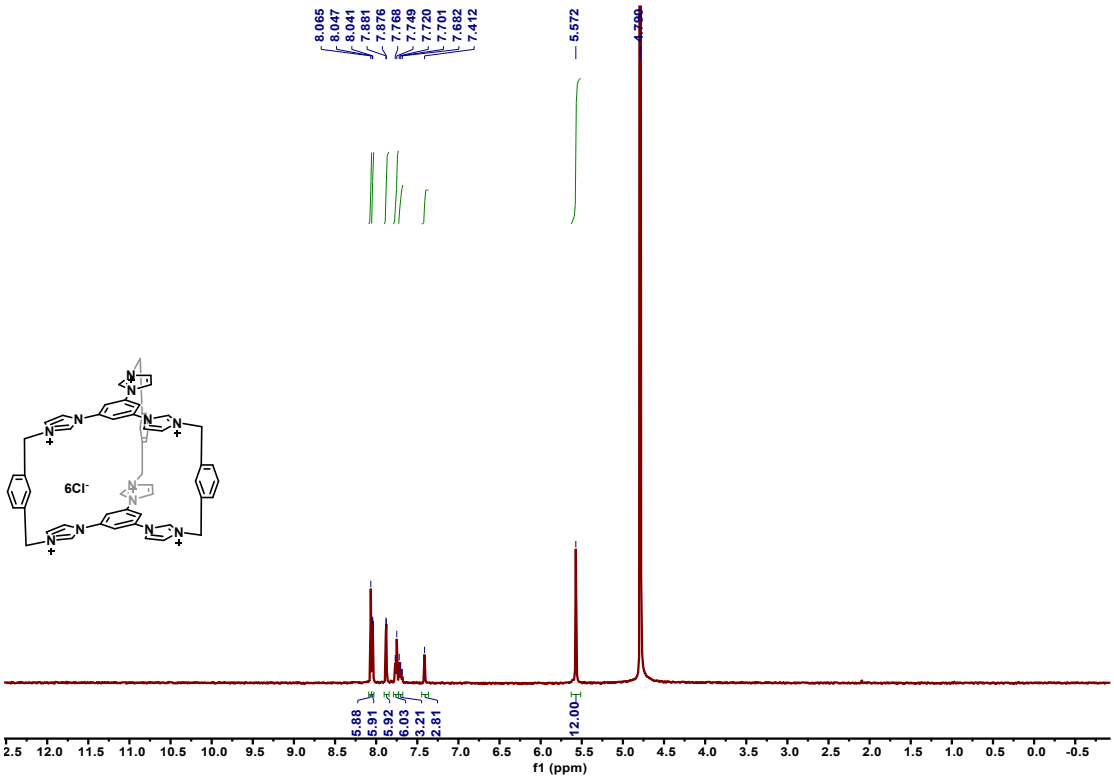
^{1}H NMR spectra of *m*-HiCage·6PF$_6$



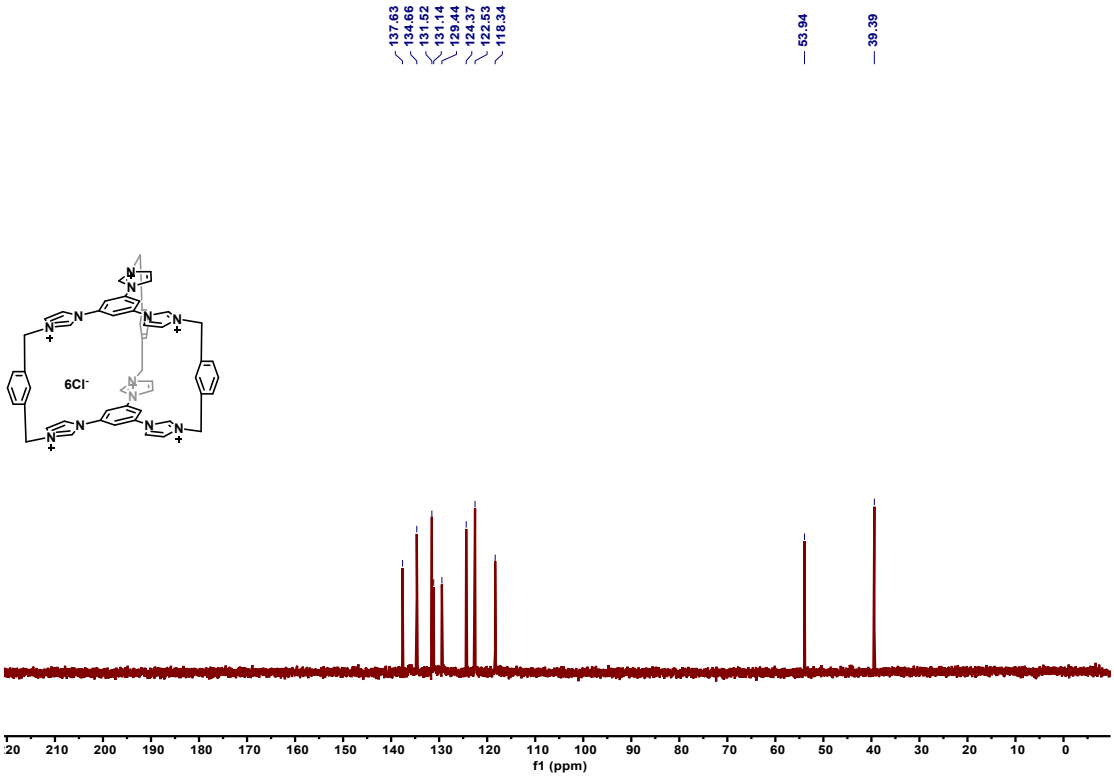
^{13}C NMR spectra of *m*-HiCage·6PF$_6$



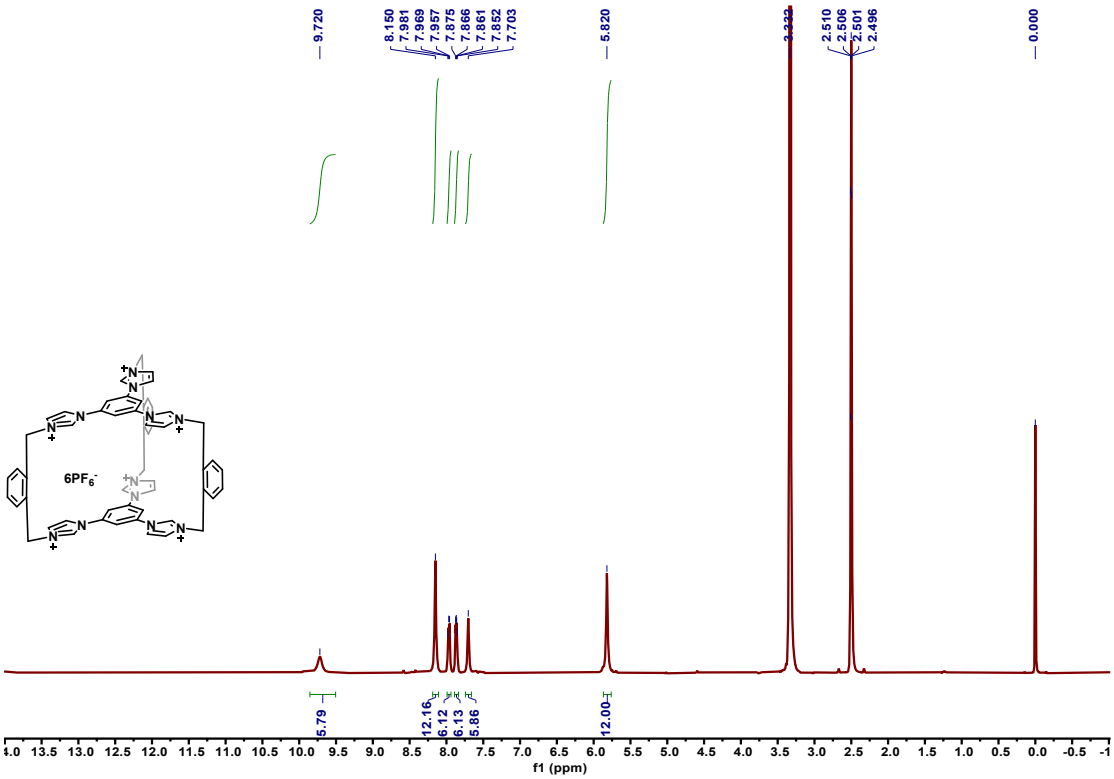
^{1}H NMR spectra of *m*-HiCage·6Cl



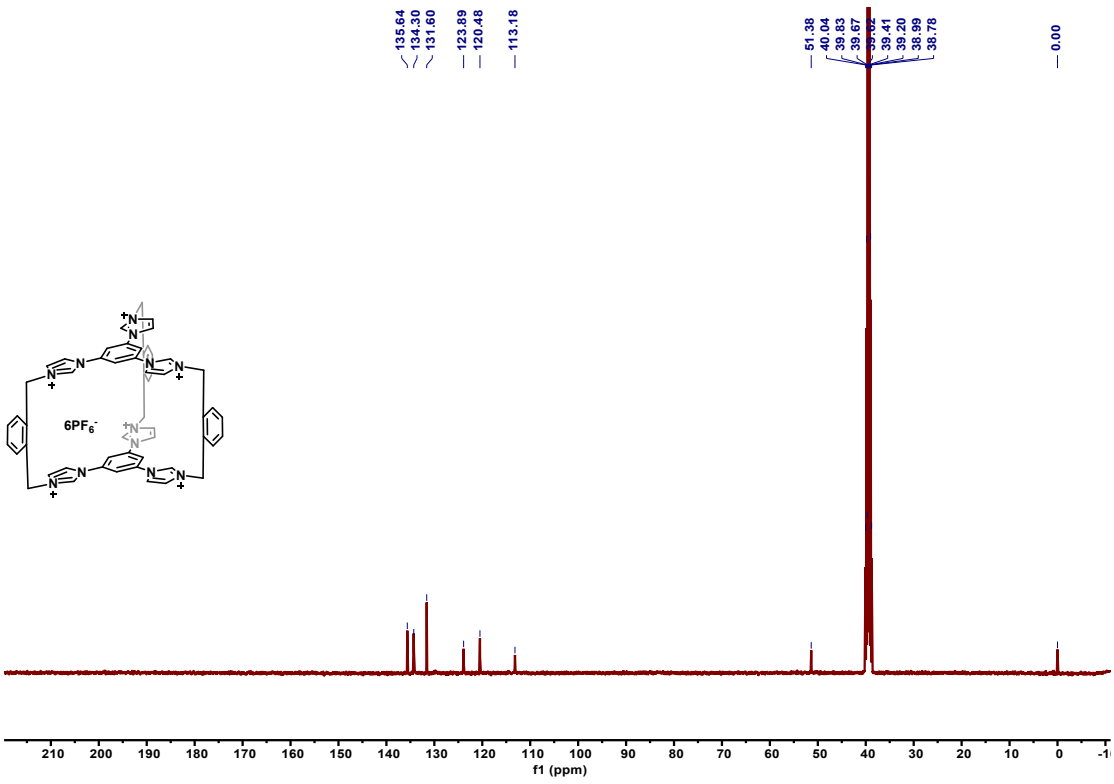
^{13}C NMR spectra of *m*-HiCage·6Cl with DMSO as internal reference (δ 39.4)



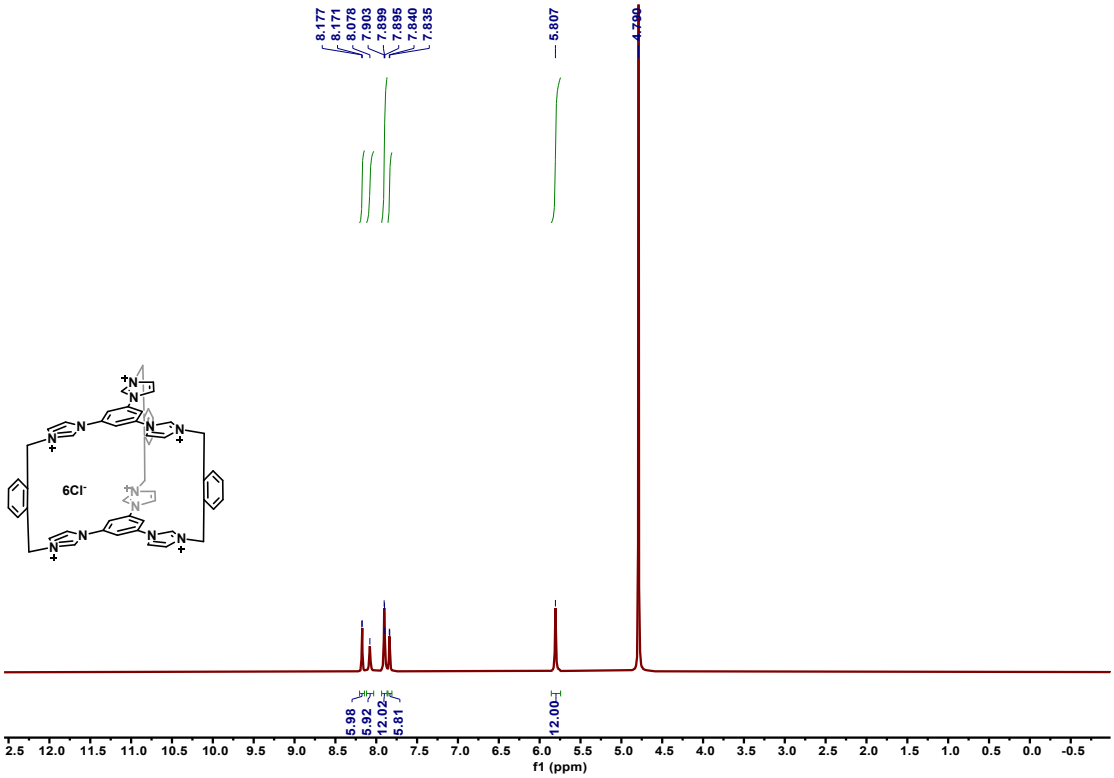
^{1}H NMR spectra of *o*-HiCage·6PF$_6$



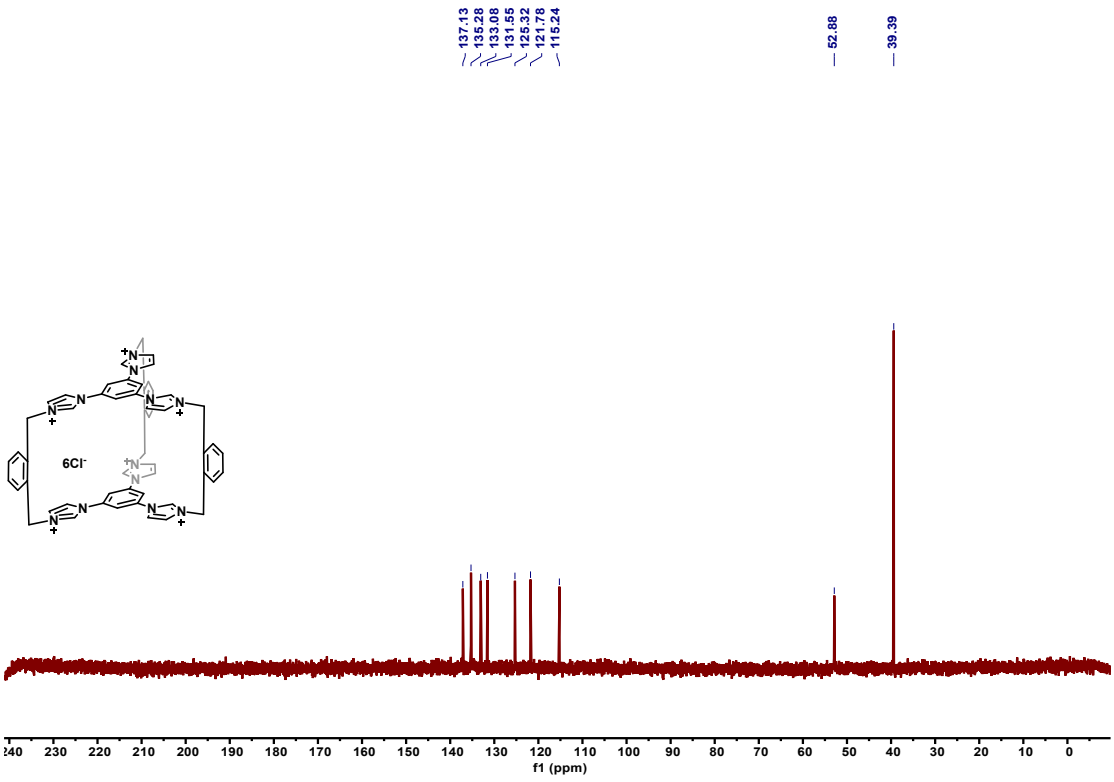
^{13}C NMR spectra of *o*-HiCage·6PF$_6$



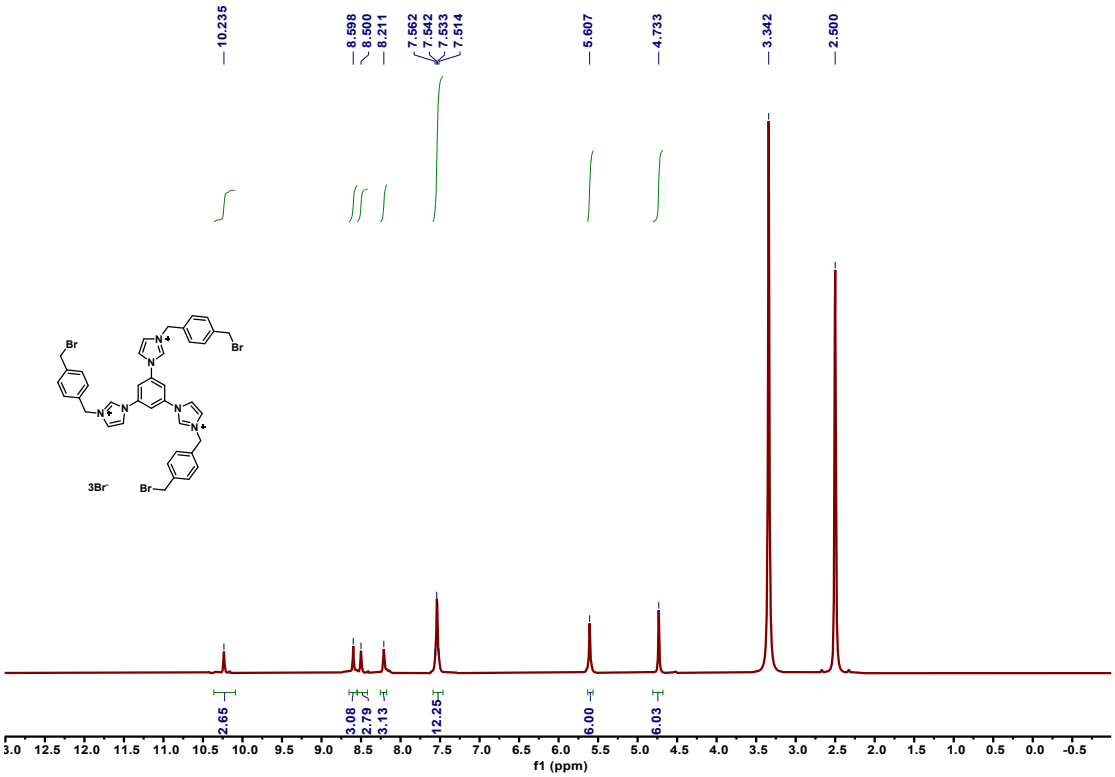
^{1}H NMR spectra of *o*-HiCage·6Cl



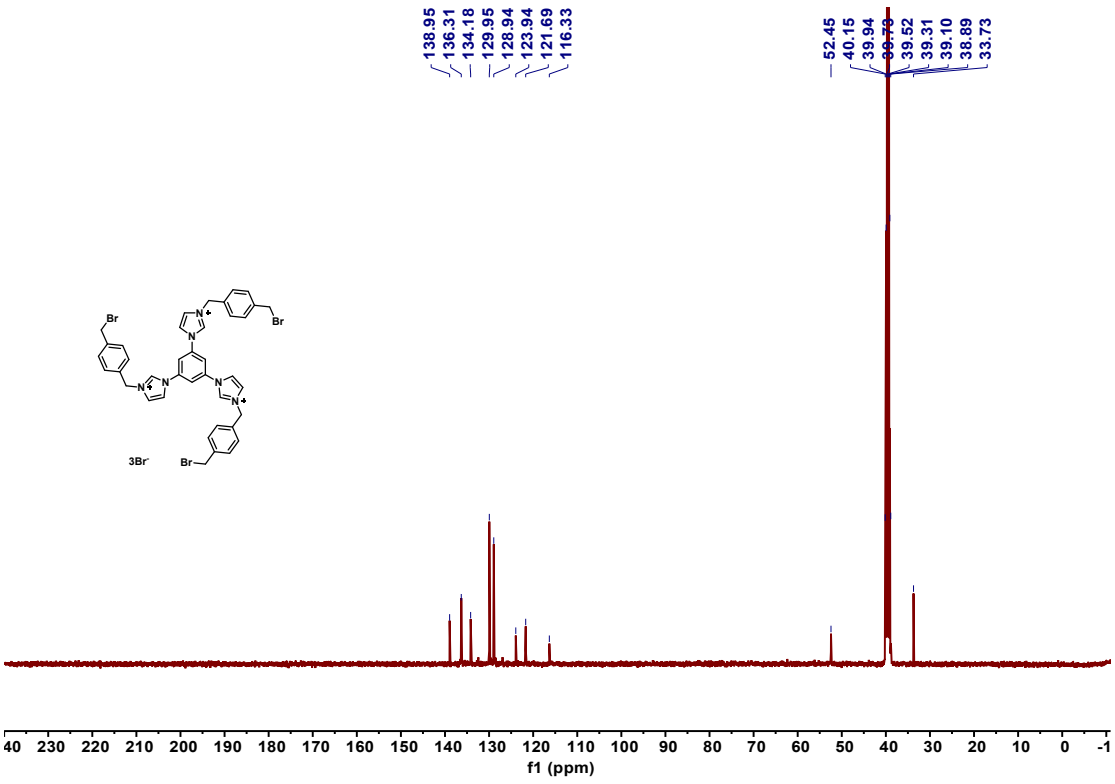
^{13}C NMR spectra of *o*-HiCage·6Cl



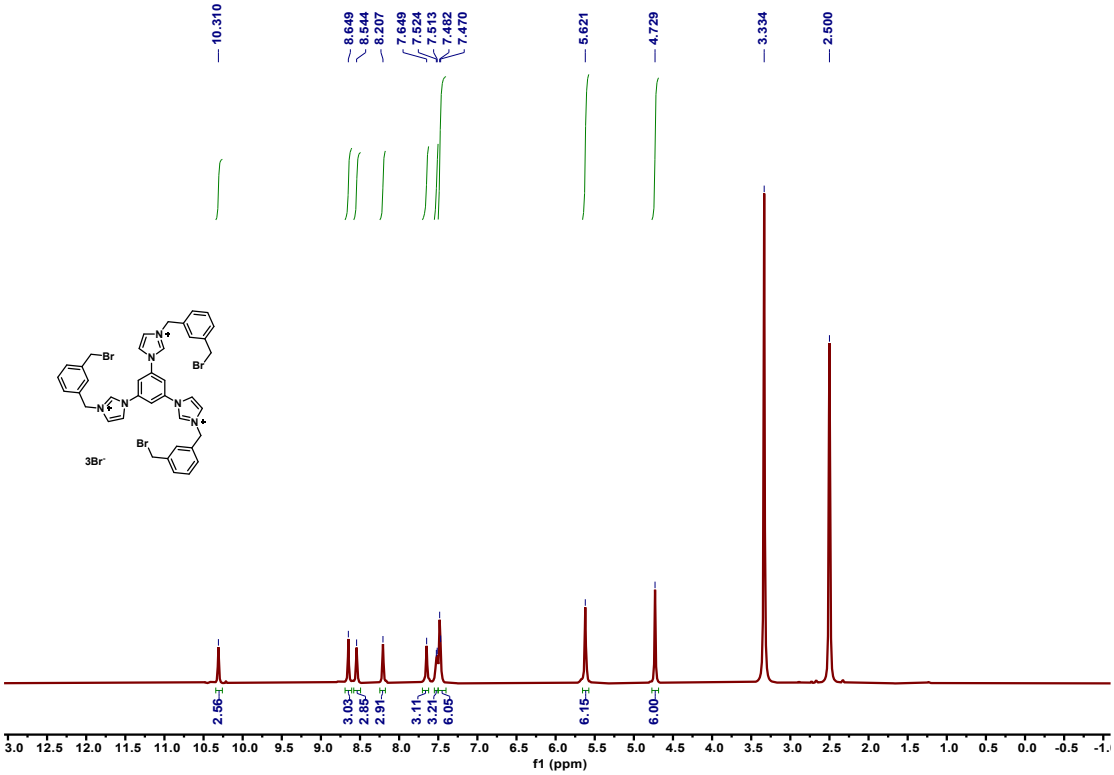
^{1}H NMR spectra of 3a·3Br



^{13}C NMR spectra of 3a·3Br



^{1}H NMR spectra of 3b·3Br



^{13}C NMR spectra of 3b·3Br