

Supporting Information

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**Reversible Photochemically Gated Transformation of a Hemicarcerand to a Carcerand\*\***

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### *Experimental Section*

Host **3**. Diol **2** (192 mg, 0.10 mmol) was dissolved in dry DMF (10 ml), anhydrous Cs<sub>2</sub>CO<sub>3</sub> (326 mg, 1 mmol) was added and stirred under Ar for 15 min. 9-chloromethylanthracene (68 mg, 0.30 mmol) was then added and the mixture was stirred at 50 °C overnight. The mixture was washed with 1N HCl and extracted with CHCl<sub>3</sub>. The organic solvent was concentrated and the crude product was purified by column chromatography using hexane/EtOAc = 10/1 as the eluent to afford **3** (182 mg, 79%) as a yellow powder. <sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz) δ 0.92 (t, *J* = 5.4 Hz, CH<sub>3</sub>, 24H), 1.30-1.53 (m, CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>, 48H), 1.90-2.21 (m, CHCH<sub>2</sub>, OCH<sub>2</sub>CH<sub>2</sub>, 28H), 3.82-3.93 (m, OCH<sub>2</sub>CH<sub>2</sub>, 12H), 4.08-4.20 (m, OCH<sub>2</sub>O (inner H), 8H), 4.55 (t, *J* = 7.8 Hz, CHCH<sub>2</sub>, 4H), 4.68 (t, *J* = 7.8 Hz, CHCH<sub>2</sub>, 4H), 4.79 (s, OCH<sub>2</sub>Ar, 4H), 5.50-5.79 (m, OCH<sub>2</sub>O (outer H), 8H), 6.65 (s, ArH, 2H), 6.73 (s, ArH, 6H), 7.20-7.33 (m, ArH, 8H), 7.52 (d, *J* = 8.1 Hz, ArH, 4H), 7.91 (s, ArH, 2H), 8.16 (d, *J* = 8.1 Hz, ArH, 4H). <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz) δ 148.9, 148.7, 148.4, 144.5, 144.0, 139.1, 138.7, 138.4, 131.5, 131.1, 129.1, 128.4, 127.5, 125.5, 124.6, 124.2, 113.8, 99.6, 73.0, 72.3, 36.9, 32.1, 29.9, 29.7, 27.7, 22.7, 14.1. MALDI HRMS calcd for C<sub>146</sub>H<sub>166</sub>O<sub>24</sub>Na 2327.12, found 2326.94 [M+Na]<sup>+</sup>.

Complexation and decomplexation studies:

**4**⊙1,4-(MeO)<sub>2</sub>C<sub>6</sub>H<sub>4</sub>. To a 10<sup>-4</sup> M solution of **3** in 5 ml degassed Ph<sub>2</sub>O was added 1.4 g 1,4-(MeO)<sub>2</sub>C<sub>6</sub>H<sub>4</sub>. The mixture was irradiated at 350 nm for 1 h and then poured into 10 ml of methanol. The precipitate was collected on a fine-mesh sintered glass funnel and dried under vacuum (25 °C) overnight to give the carceplex as a light yellow solid. <sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz) δ -0.37 (s, OCH<sub>3</sub>, 6H), 0.92 (t, *J* = 5.4 Hz, CH<sub>3</sub>, 24H), 1.28-1.55 (m, CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>, 48H), 1.90-2.25 (m, CHCH<sub>2</sub>, OCH<sub>2</sub>CH<sub>2</sub>, 28H), 3.78-3.96 (m, OCH<sub>2</sub>CH<sub>2</sub>, 12H), 4.25-4.35 (m, OCH<sub>2</sub>O (inner H), 8H), 4.45 (s, 2H, CH), 4.70-4.80 (m, CHCH<sub>2</sub>, OCH<sub>2</sub>Ar, 12H), 5.80-5.92 (m, OCH<sub>2</sub>O (outer H), 8H), 5.95 (s,

ArH, 4H), 6.60 (s, ArH, 2H), 6.75-6.92 (m, ArH, 22H). MALDI HRMS calcd for  $C_{154}H_{176}O_{26}Na$  2465.28, found 2465.40  $[M+Na]^+$ .

Stability of  $4\text{O}1,4\text{-(MeO)}_2\text{C}_6\text{H}_4$ . A solution of 3 mg carceplex  $4\text{O}1,4\text{-(MeO)}_2\text{C}_6\text{H}_4$  in 1 ml of  $\text{CDCl}_3$  at 25 °C was monitored by  $^1\text{H}$  NMR for 4 weeks, and no change was observed in the spectrum.

Decomplexation of  $4\text{O}1,4\text{-(MeO)}_2\text{C}_6\text{H}_4$ . A solution of 3 mg carceplex  $4\text{O}1,4\text{-(MeO)}_2\text{C}_6\text{H}_4$  in 1 ml of  $\text{CDCl}_3$  at 25 °C was irradiated at 254 nm for 1 h. The decomplexation was monitored by following the decrease of the intensity of the singlet at -0.37 ppm and the reappearance of the anthracene peaks from 7.20-8.20 ppm in the  $^1\text{H}$  NMR spectrum.

Other guest molecules:

The complexation and decomplexation studies for the other guest molecules (Table S1, Supporting Information) were similar to that of 1,4-dimethoxybenzene.

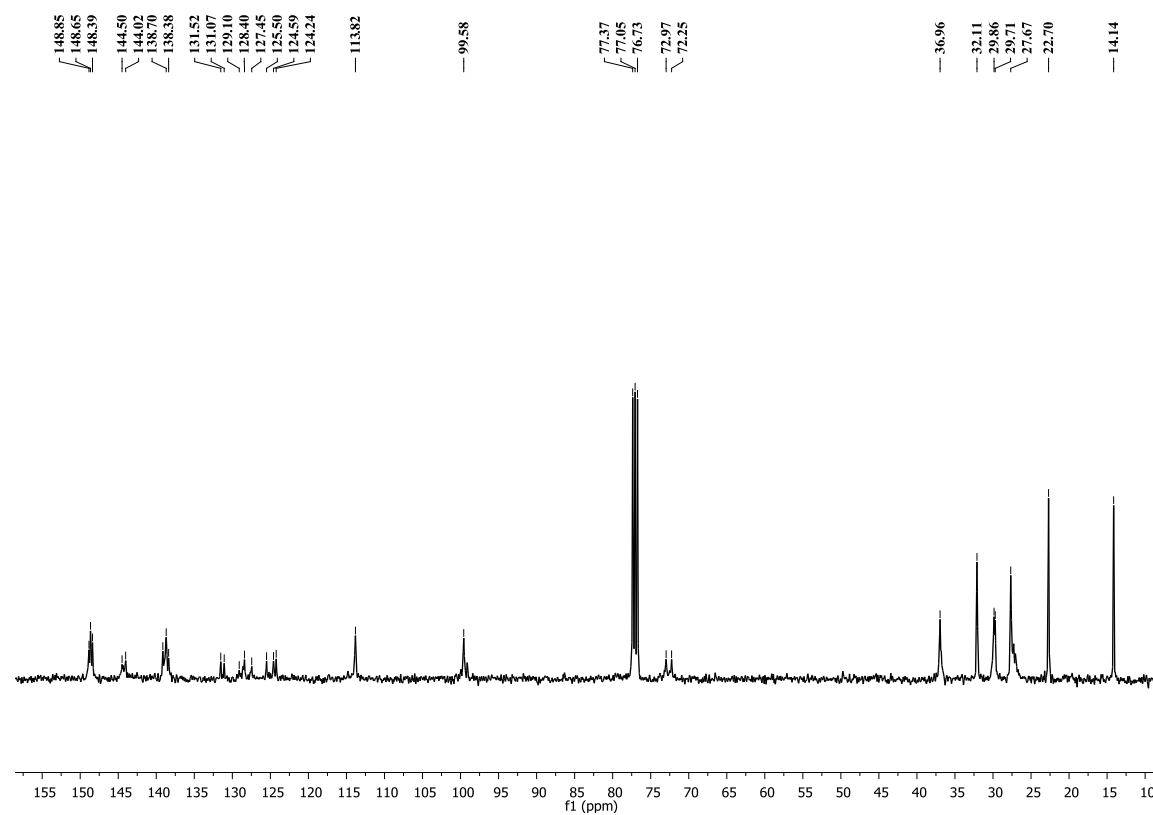
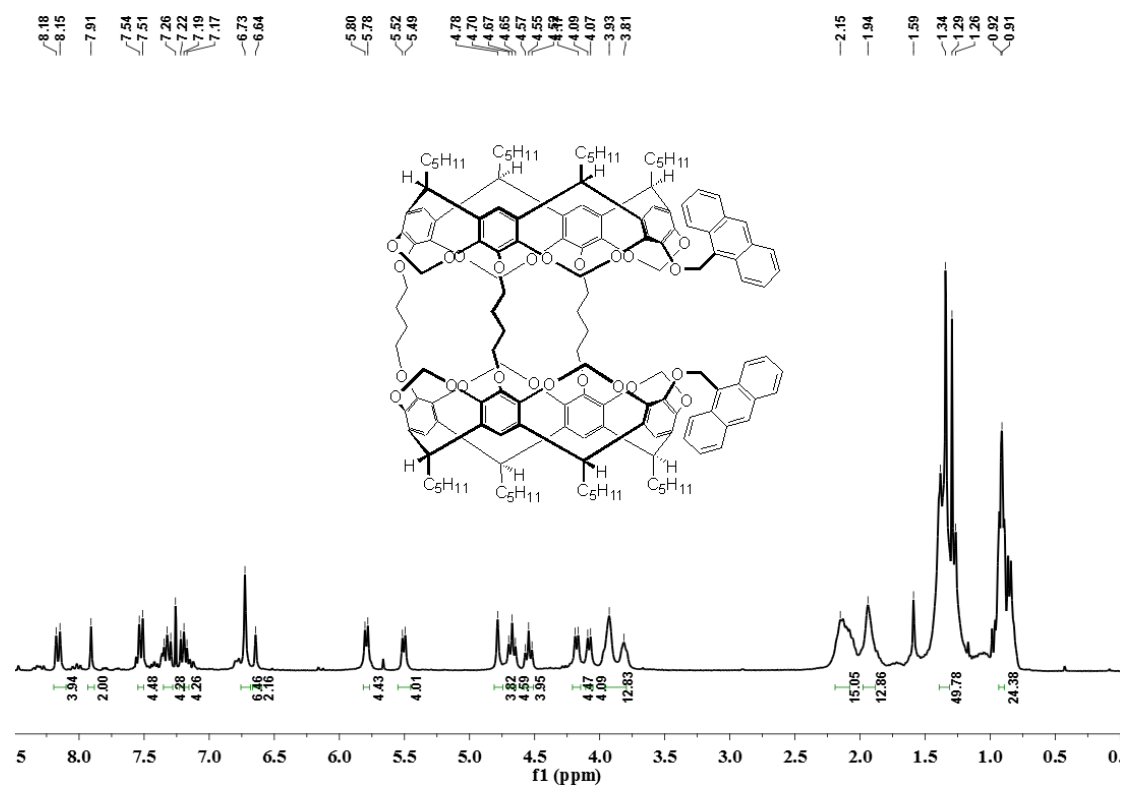


Figure S1: <sup>1</sup>H NMR and <sup>13</sup>C NMR spectra of **3**.

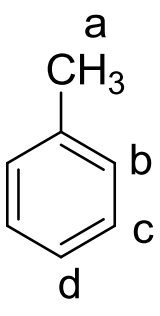
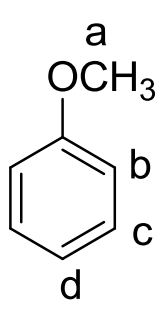
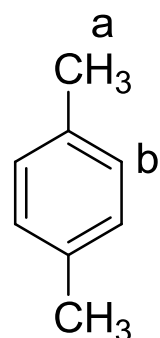
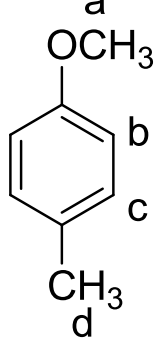
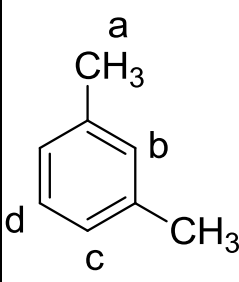
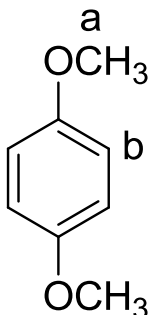
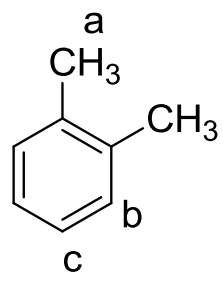
Guest	H	$\Delta\delta$ (ppm)	Guest	H	$\Delta\delta$ (ppm)
	$H_a$	3.96		$H_a$	3.87
	$H_b$	1.53		$H_b$	1.60
	$H_c$	1.85		$H_c$	1.95
	$H_d$	3.35		$H_d$	3.30
	$H_a$	4.17		$H_a$	4.01
	$H_b$	1.06		$H_b$	0.84
				$H_c$	0.98
				$H_d$	4.21
	$H_a$	3.17		$H_a$	4.15
	$H_b$	hidden		$H_b$	0.85
	$H_c$	1.86			
	$H_d$	hidden			
	$H_a$	2.34	$CH_aCl_2-CHCl_2$	$H_a$	0.95
	$H_b$	1.54			
	$H_c$	1.95	$CH_aBr_2-CHBr_2$	$H_a$	1.02

Table S1: Complexation of **4** with various guest molecules and the chemical shift changes of corresponding Hs (before and after complexations) on the guests.

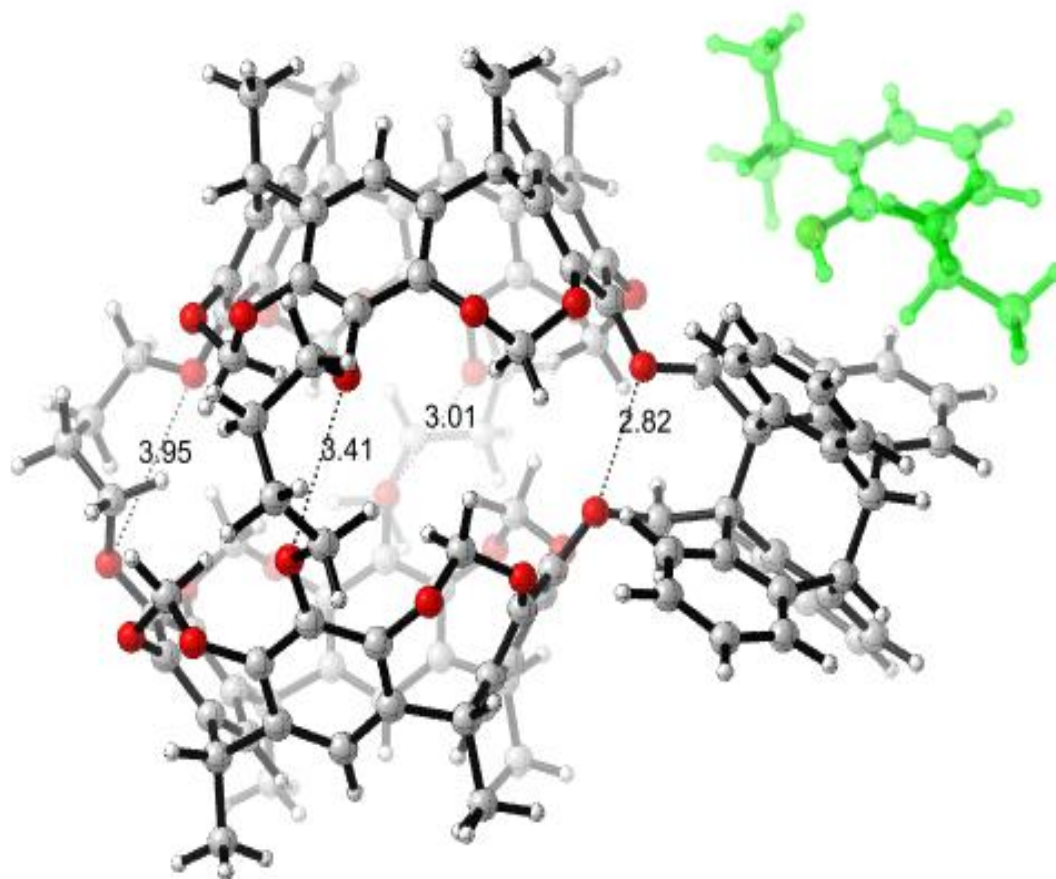


Figure S2: Molecular modelling of complexation of **4** with propofol (2,6-diisopropylphenol) using Schrödinger Macromodel (OPLS\_2005, GB/SA CHCl<sub>3</sub>). (The geometry began with the guest inside the host; the guest came out of the host after the minimization)