Electronic Supplementary Information (ESI)

The partially controllable growth trend of carbon nanoparticles in solid-state pyrolysis of organometallic precursor by introducing POSS units, and their magnetic properties

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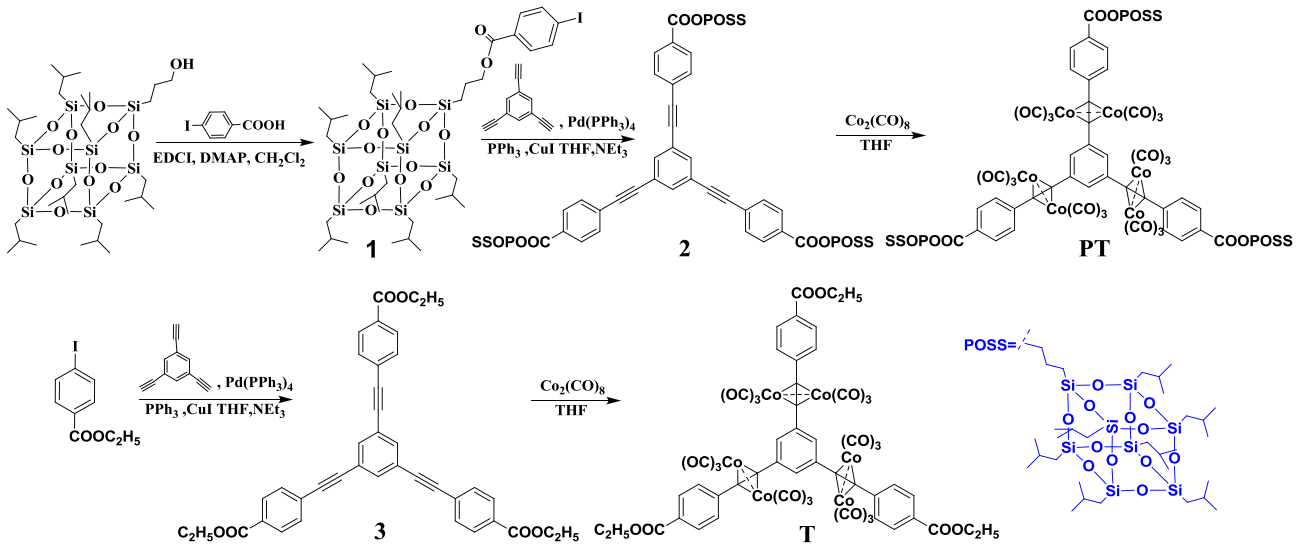

Scheme S1. Synthetic pathway of **PT**.

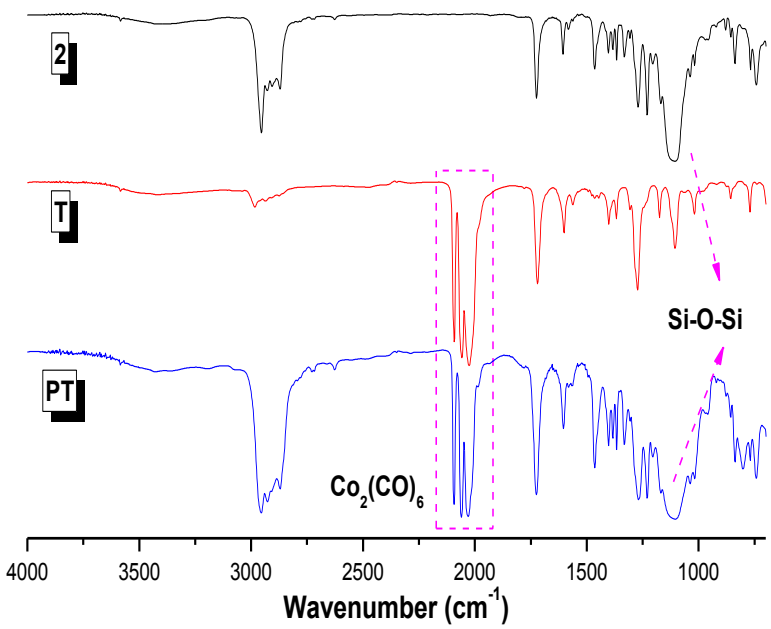

Figure S1. IR spectra of **2**, **T** and **PT**.

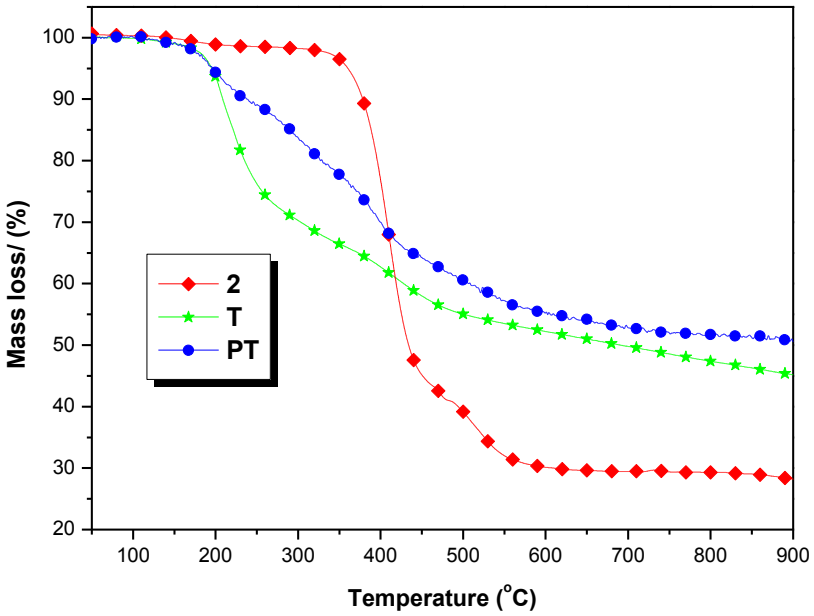

Figure S2. TGA thermograms of **2**, **T** and **PT** measured under nitrogen at a heating rate of 10 ^{o}C min^{-1}.

Thermal properties and pyrolysis program

The pyrolysis program, such as heating rate, temperature and holding time had a significant influence on the structure of the yielded CNPs. Generally, the samples were first heated to their decomposition temperature of the Co-carbonyl groups and held at this temperature for several hours, then heated to a high temperature and held there for another several hours. In order to determine our pyrolysis program, the thermal properties of compounds **2**, **T** and **PT** were investigated by using

thermogravimetric analysis. The thermal-decomposition temperatures (T_d, corresponding to 5% weight loss) of **T** and **PT** were ~180 ^{o}C. Thus, we determined the pyrolysis program as following: powders of the organometallic precursor were placed in quartz tubes sealed under high vacuum, then suffered to different heating programs in a furnace. The samples were first heated slowly to their decomposition temperature 180 ℃, held for two hours to ensure the completely decomposition of the Co complexes, and then heated to a higher temperature where the sample was held for several hours. After slowly cooled to room temperature, the obtained products were characterized by using powder X-ray diffraction (XRD), scanning electron (SEM) and transmission electron (TEM) microscopy, energy-dispersive spectroscopy (EDS) and vibrating sample magnetometer.

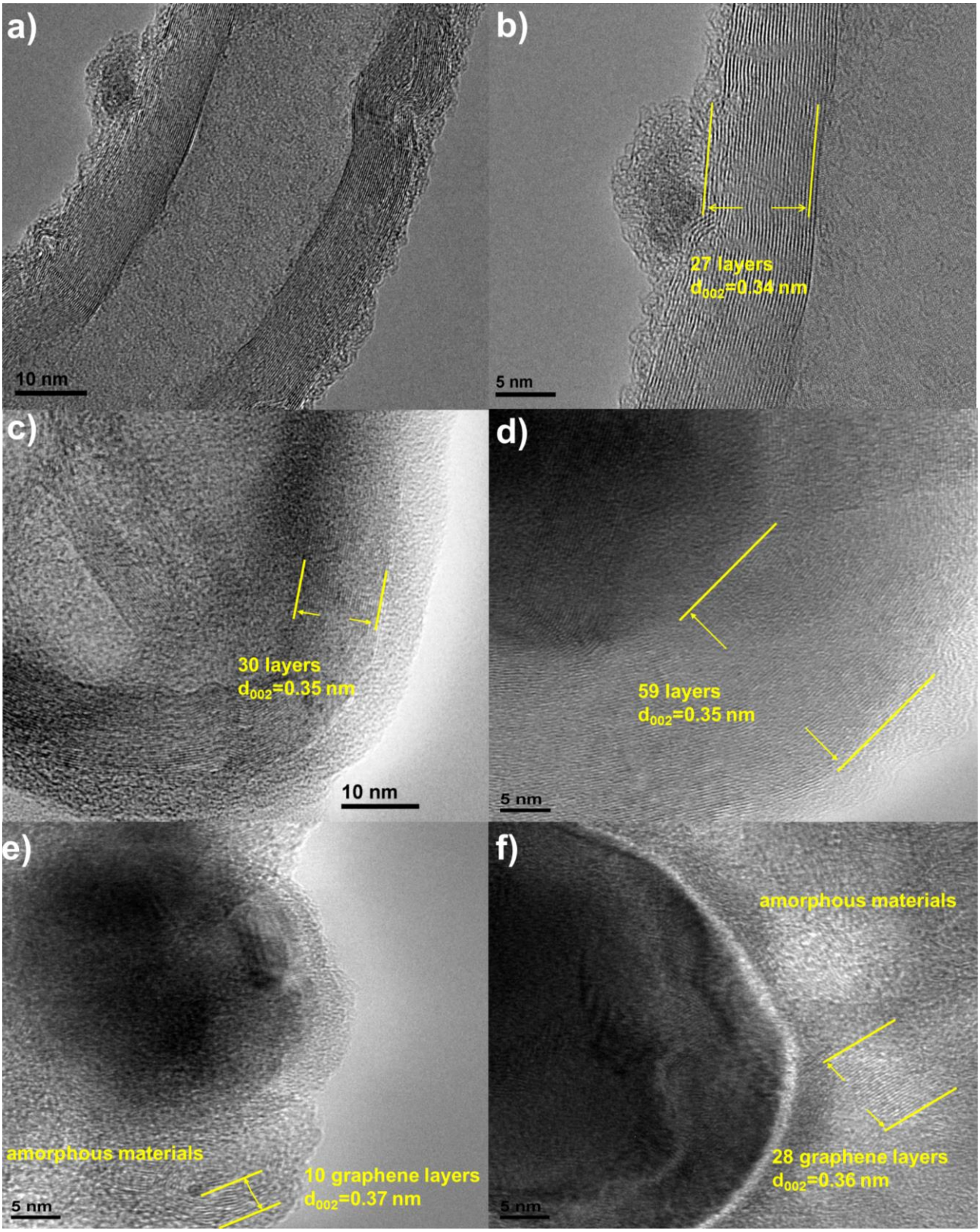

Figure S3. HRTEM images of the materials obtained through thermolysis of **T** and **PT**. (a, b) for **T-700-24h**; (c, d) for **T-850-8h**; (e) for **PT-700-24h**; (f) for **PT-850-8h**.

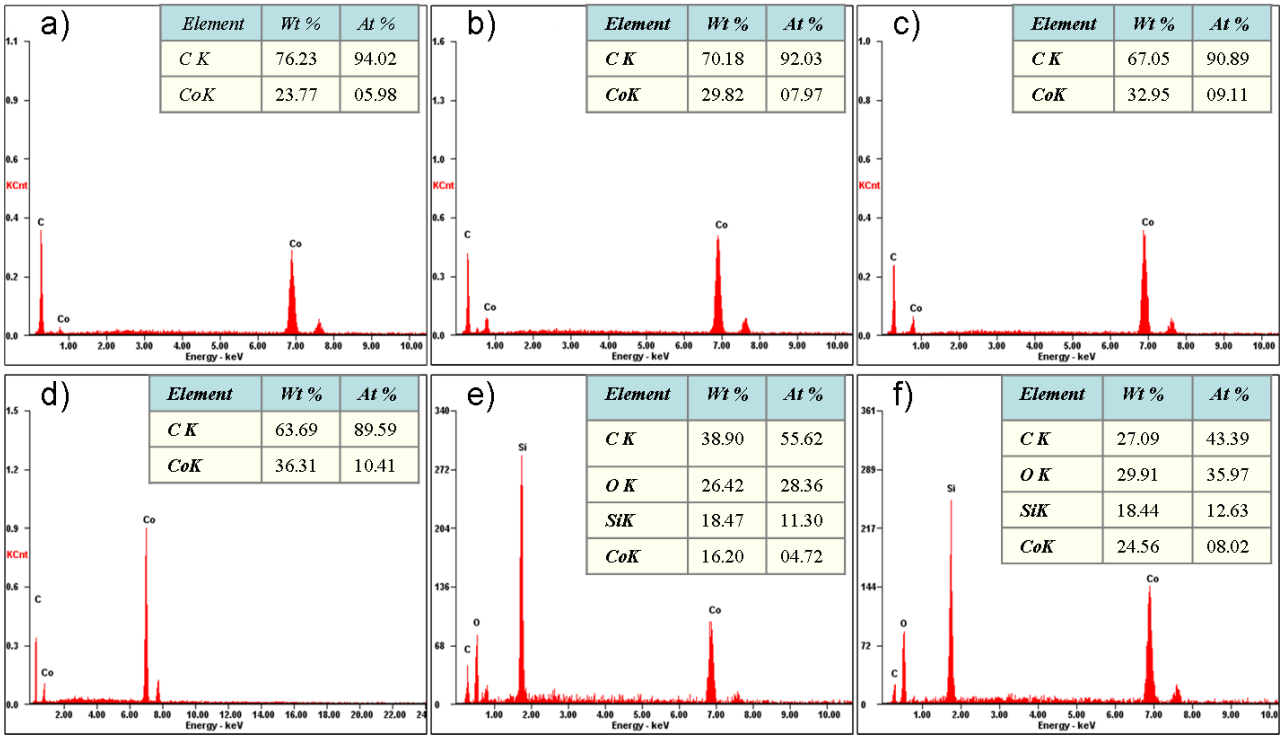

Figure S4. SEM-EDX spectra of the materials obtained through thermolysis of compounds: a) **T-700-8h**, b) **T-700-24h**, c) **T-800-8h**, d) **T-850-8h**, e) **PT-700-24h** and f) **PT-850-8h**.

Table S1. Compositions of organometallic precursors and their pyrolysis products.

sample	C (%)	Co(%)	Si(%)	O(%)
T	47.1	24.3	0.00	26.4
T-700-8h	76.2	23.8	-[a]	-
T-700-24h	70.2	29.8	-	-
T-800-8h	67.0	33.0	-	-
T-850-8h	63.7	36.3	-	-
PT	43.9	9.0	17.1	24.4
PT-700-24h	38.9	16.2	18.5	26.4
PT-850-8h	27.1	24.6	18.4	29.9

[a.] The symbol of "-" represents the element was not detected.

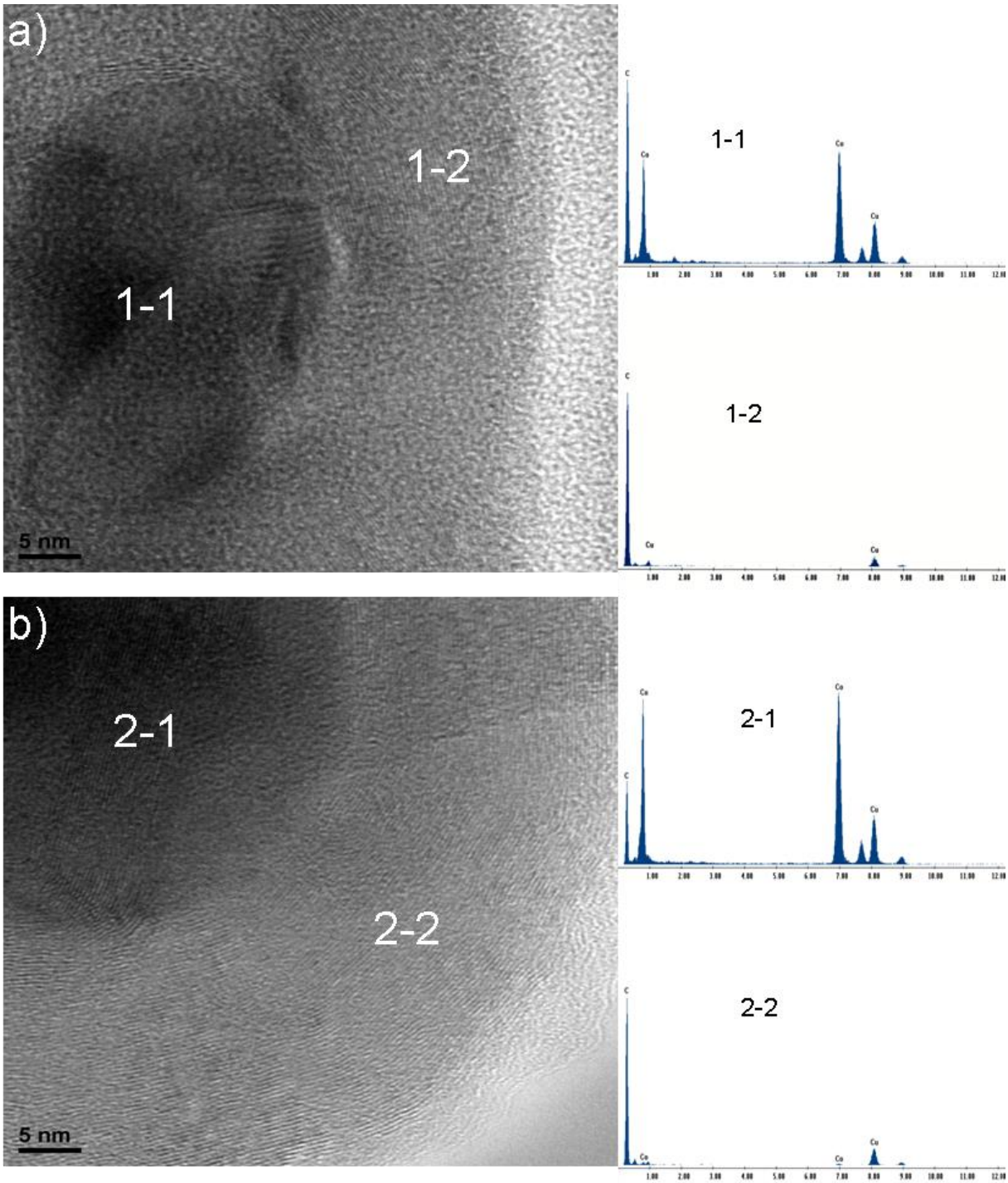

Figure S5. TEM-EDX spectra of (a) **T-700-24h** and (b) **T-850-8h**.

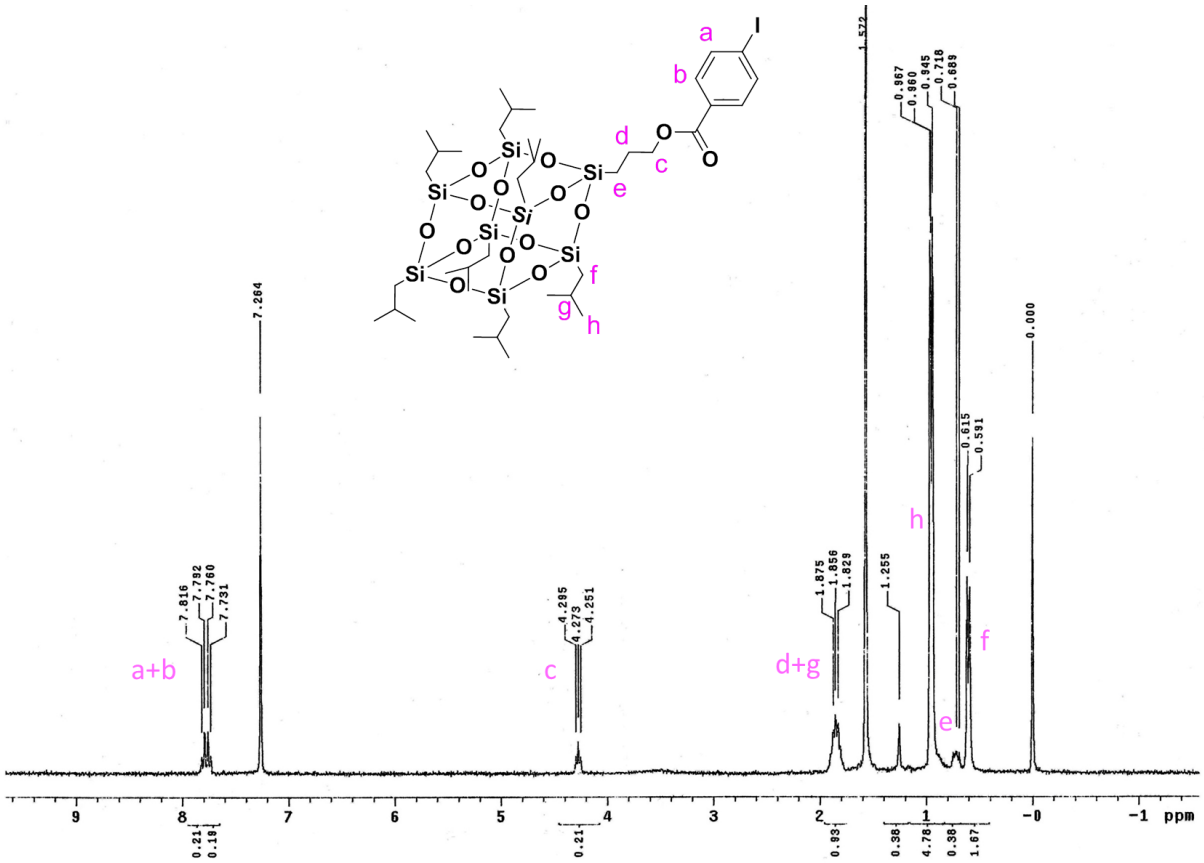

Figure S6. ^{1}H NMR spectrum of **1** in $CDCl_3$

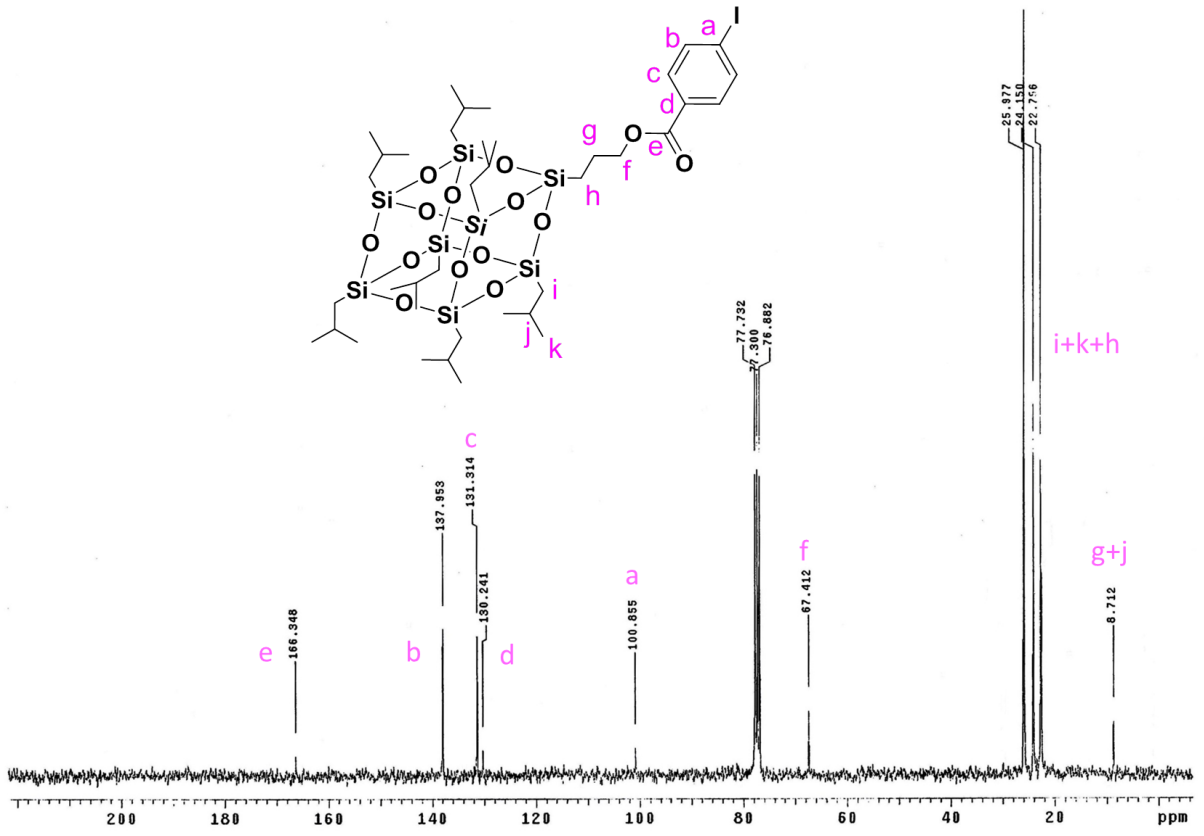

Figure S7. ^{13}C NMR spectrum of **1** in $CDCl_3$.

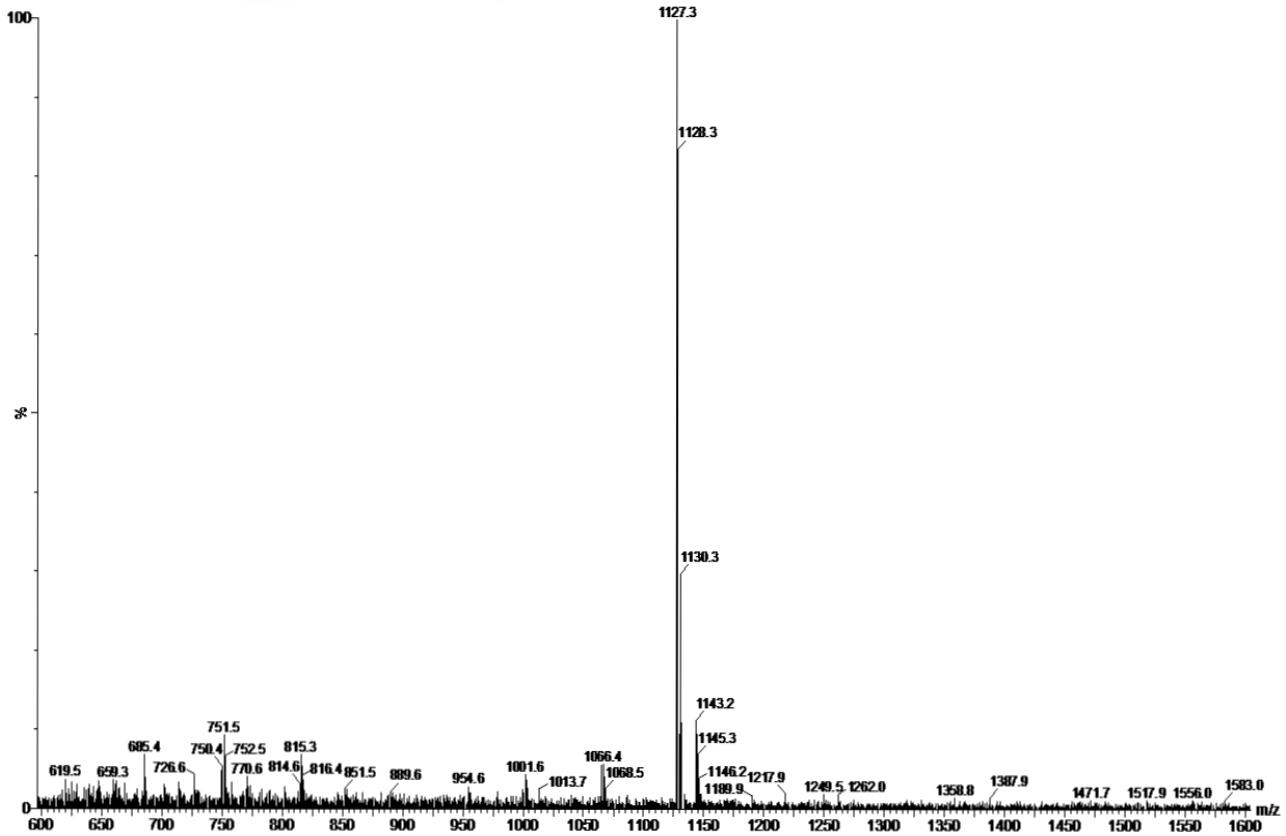

Figure S8. MALDI-TOF spectrum of **1**.

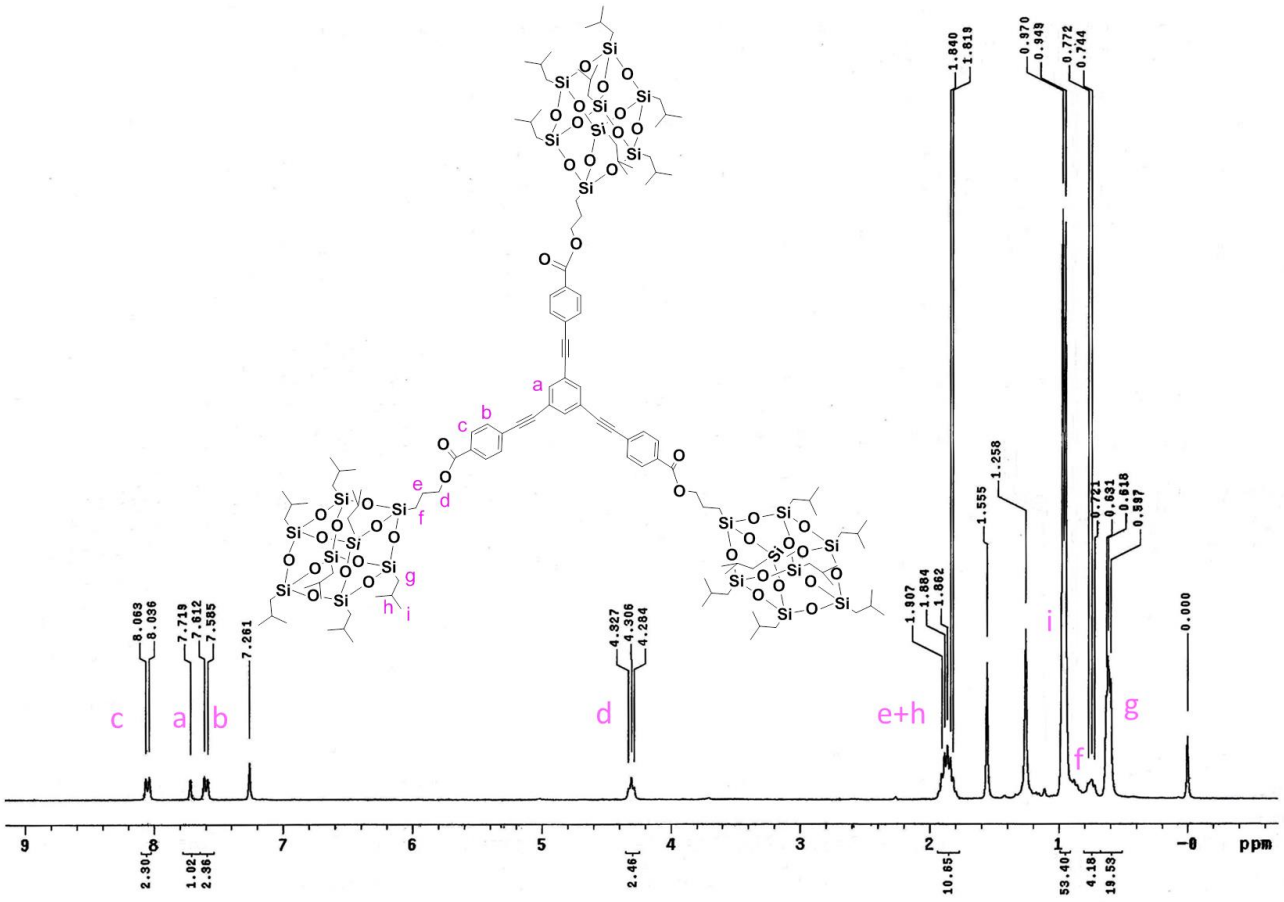

Figure S9. ^{1}H NMR spectrum of **2** in $CDCl_3$.

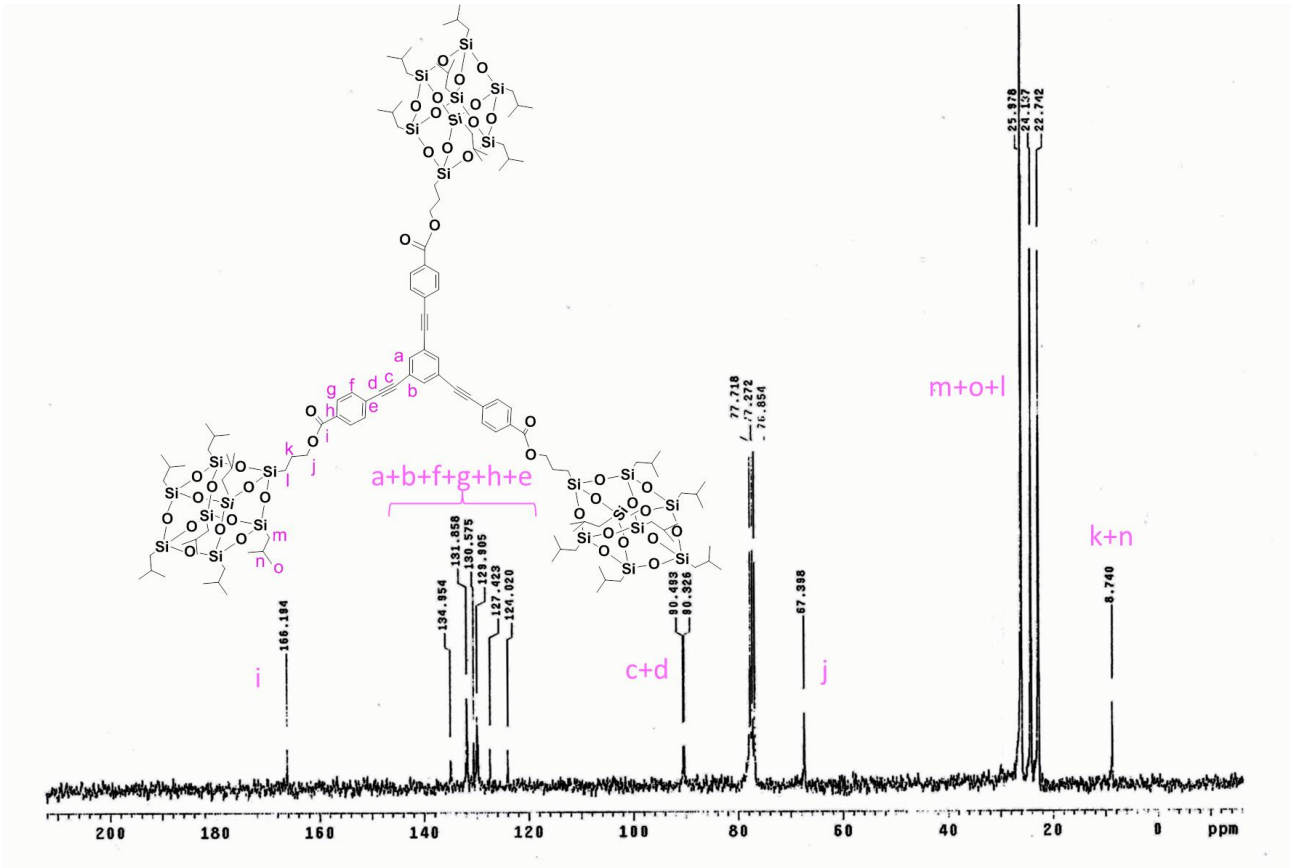

Figure S10. ^{13}C NMR spectrum of **2** in $CDCl_3$.

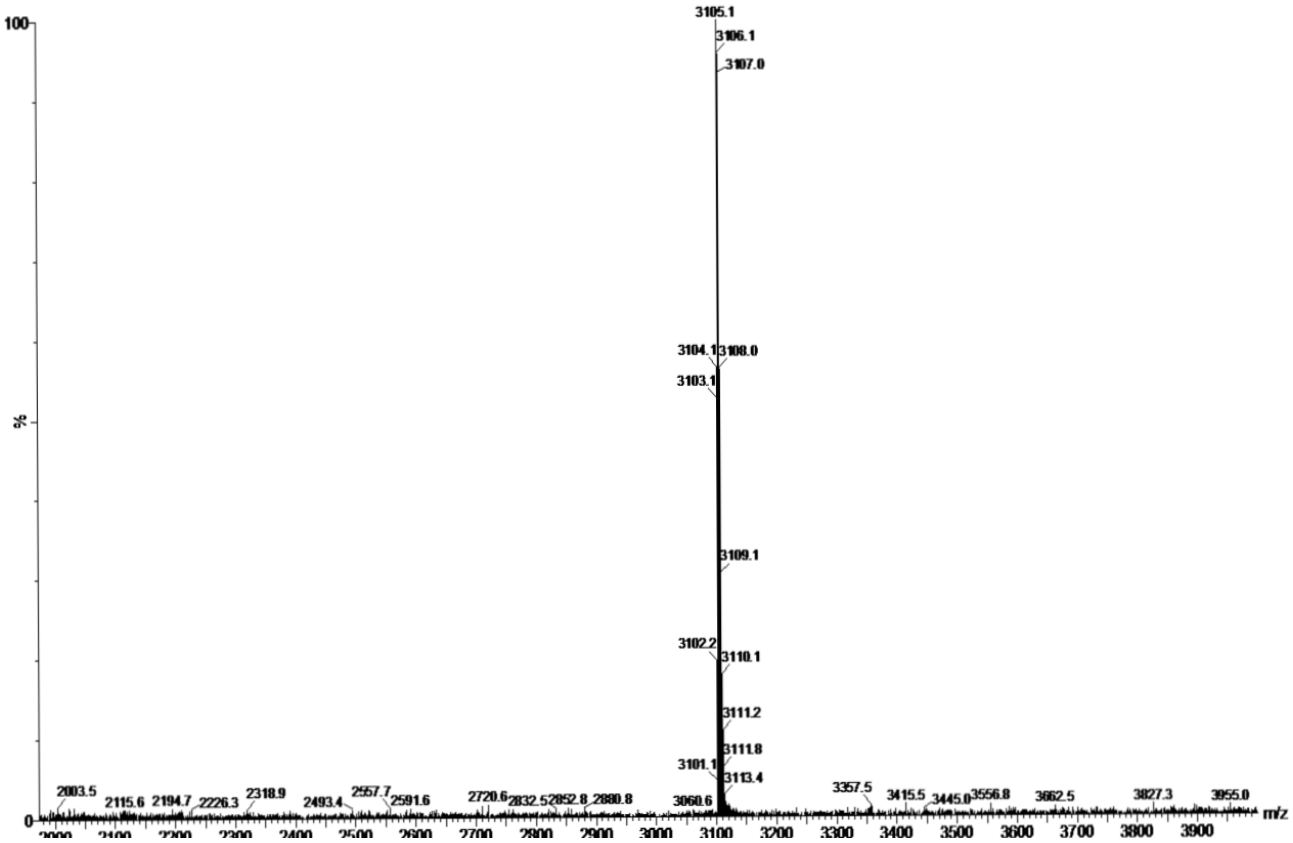

Figure S11. MALDI-TOF spectrum of **2**.

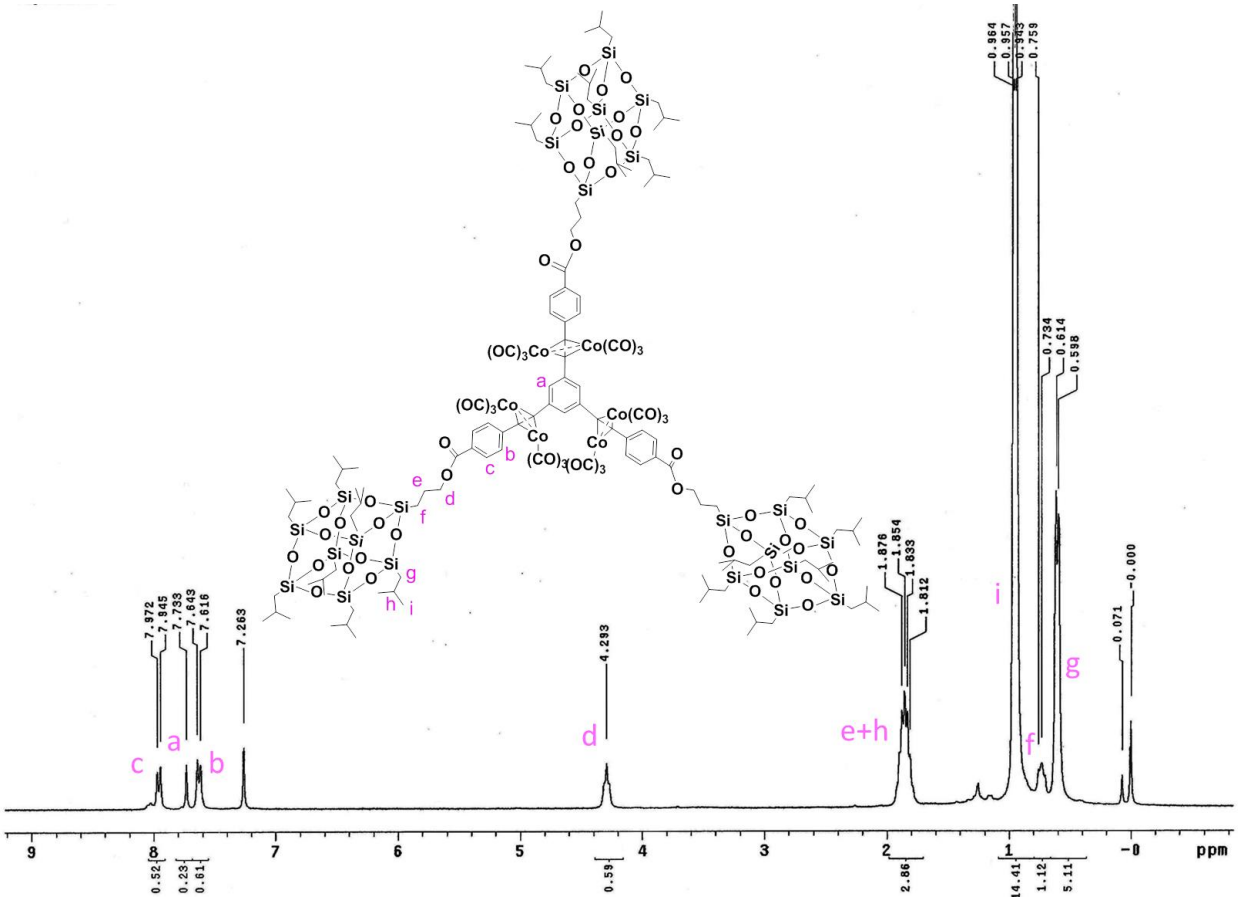

Figure S12. ^{1}H NMR spectrum of **PT** in $CDCl_3$.

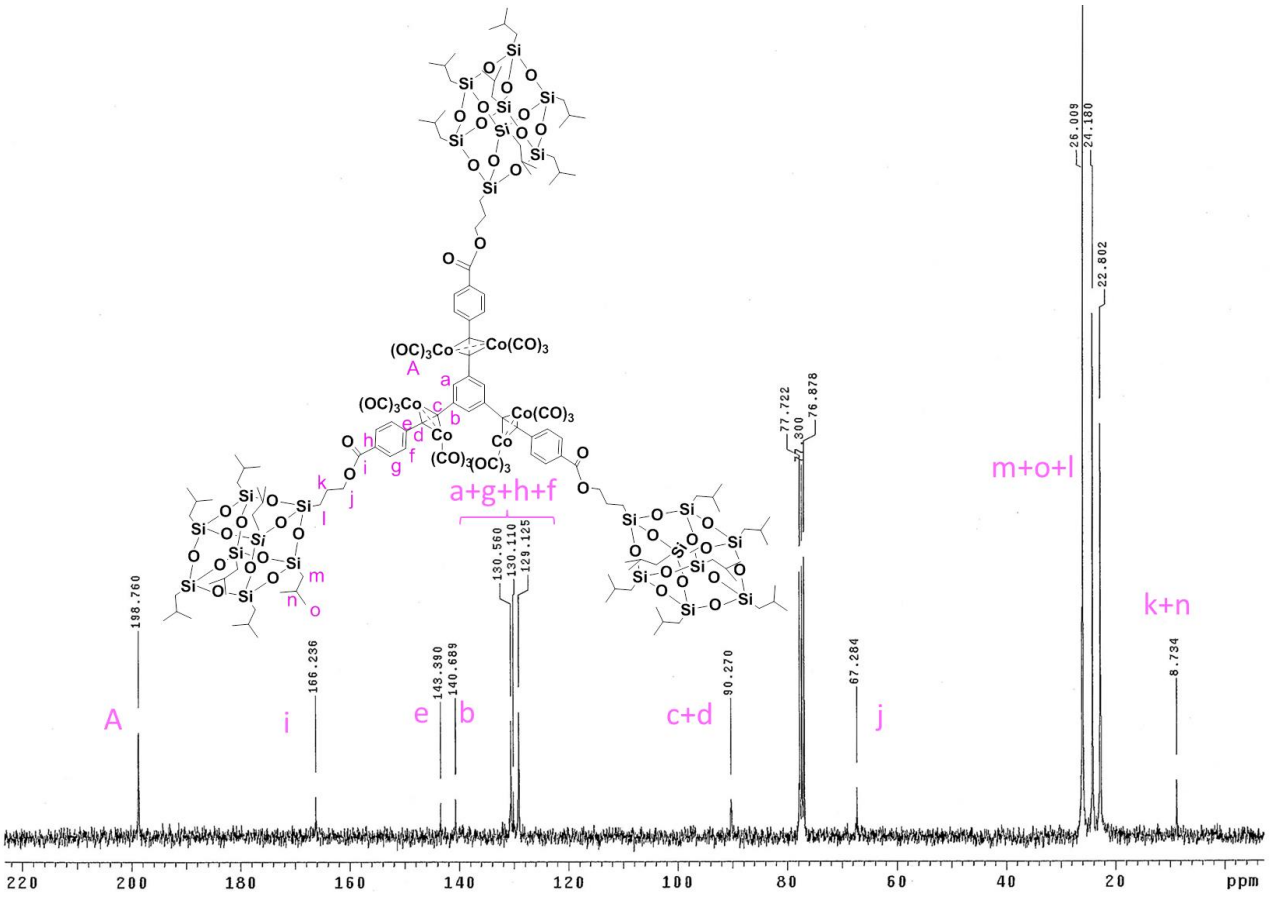

Figure S13. ^{13}C NMR spectrum of **PT** in $CDCl_3$.

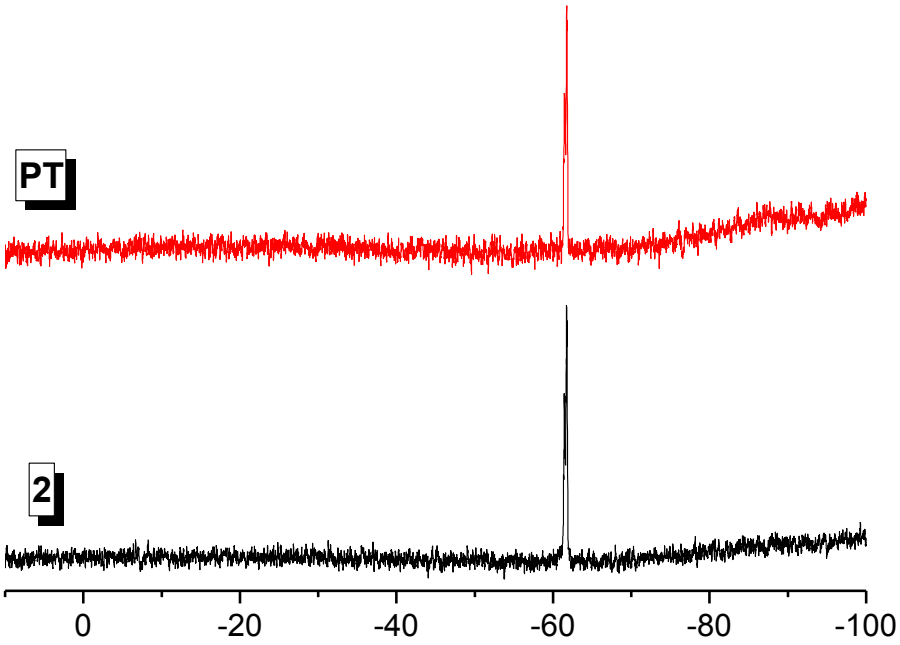

Figure S14. ^{29}Si NMR spectra of **2** and **PT** in $CDCl_3$.