

Supplementary Material

Magnetic and Electronic Properties of Three New Hetero-bimetallic Coordination Frameworks, $[\text{Ru}_2(\text{O}_2\text{CR})_4][\text{Au}(\text{CN})_2]$ ($\text{R} = \text{benzoic acid, furan-2-carboxylate or thiophene-2-carboxylate}$)

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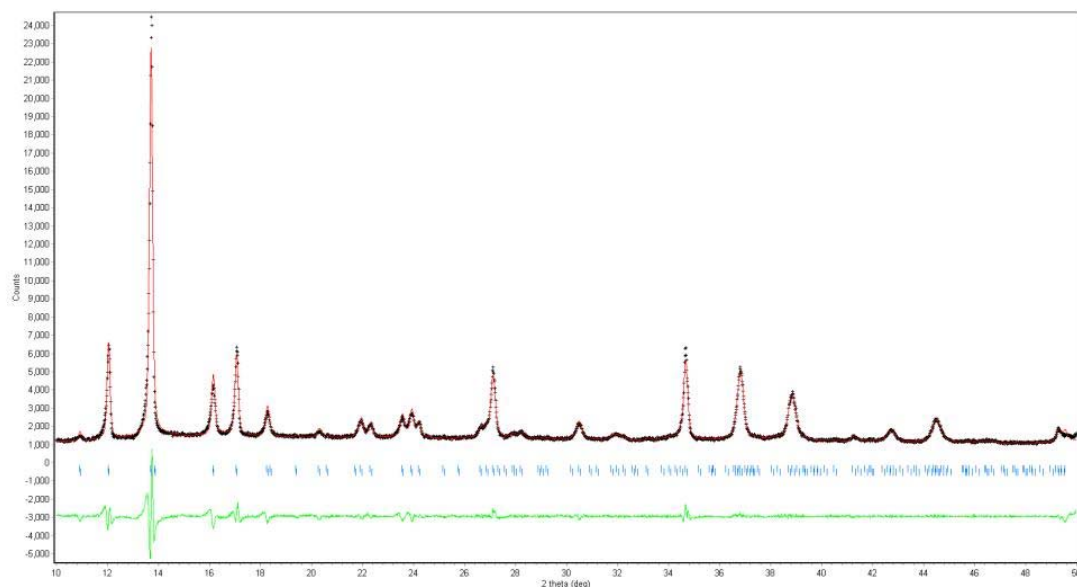


Figure S1. Le Bail fit of the PXRD pattern for **1(Thio)** at 293 K; unit cell parameters

$$a = 10.4064(4), c = 25.8797(11) \text{ \AA} \text{ and } V = 2802.6(2) \text{ \AA}^3.$$

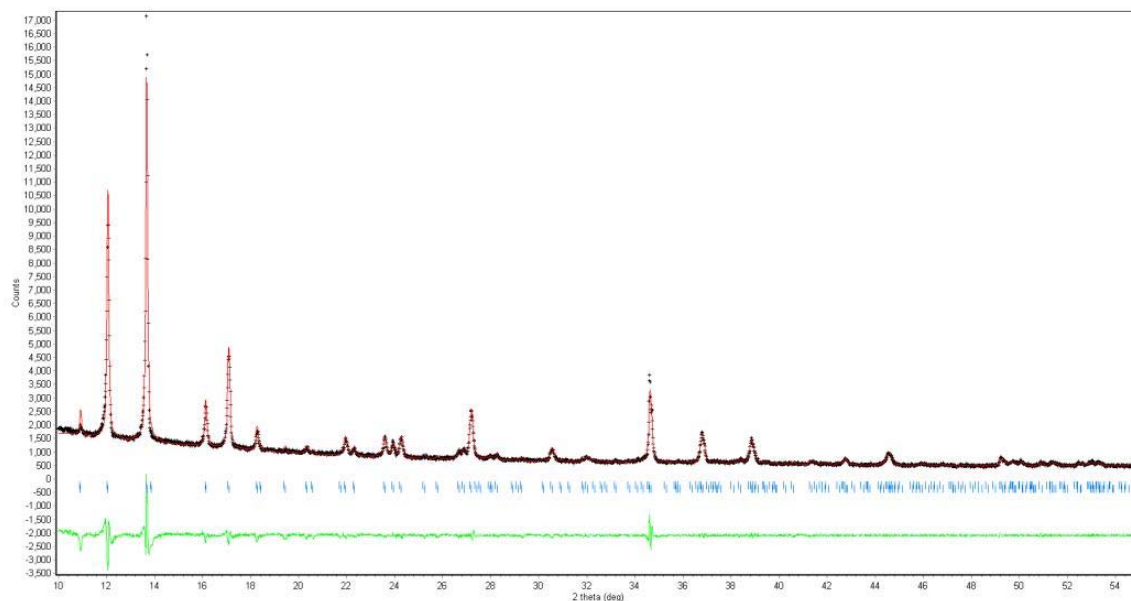


Figure S2. Le Bail fit of the PXRD pattern for **1(Furan)** at 293 K; unit cell parameters $a = 10.3837(3)$, $c = 25.9083(10)$ Å and $V = 2793.50(17)$ Å³.

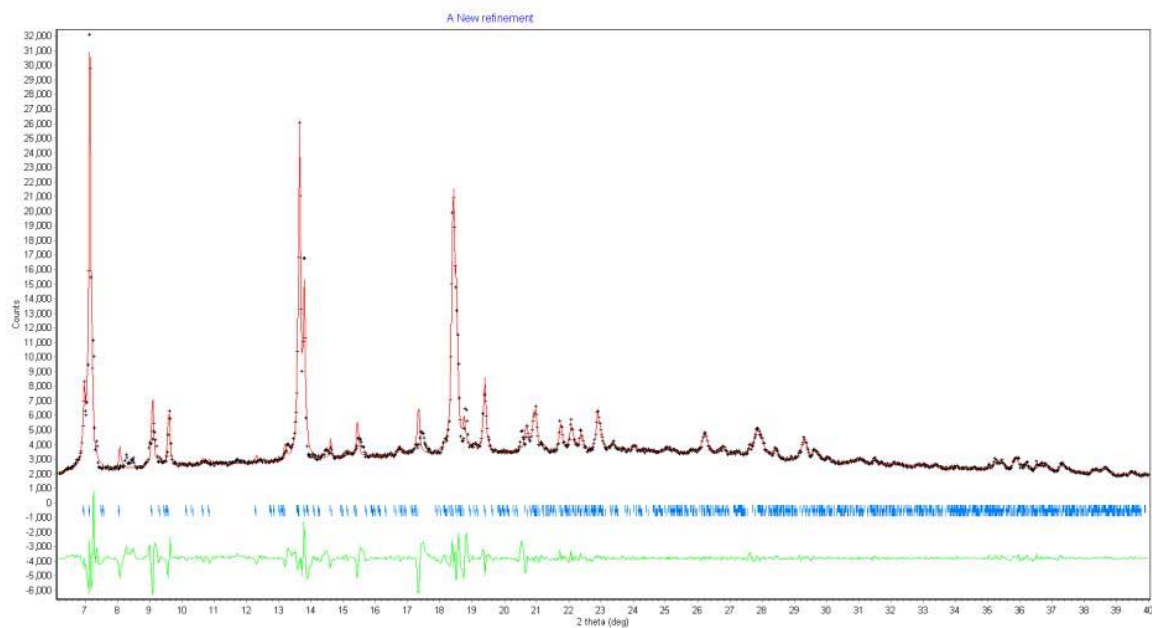


Figure S3. Le Bail fit of the PXRD pattern for **1(Ph)** at 293 K; unit cell parameters $a = 40.296(5)$, $b = 13.5091(17)$, $c = 25.661(6)$ Å, $\beta = 103.521(13)^\circ$ and $V = 12651(4)$ Å³.

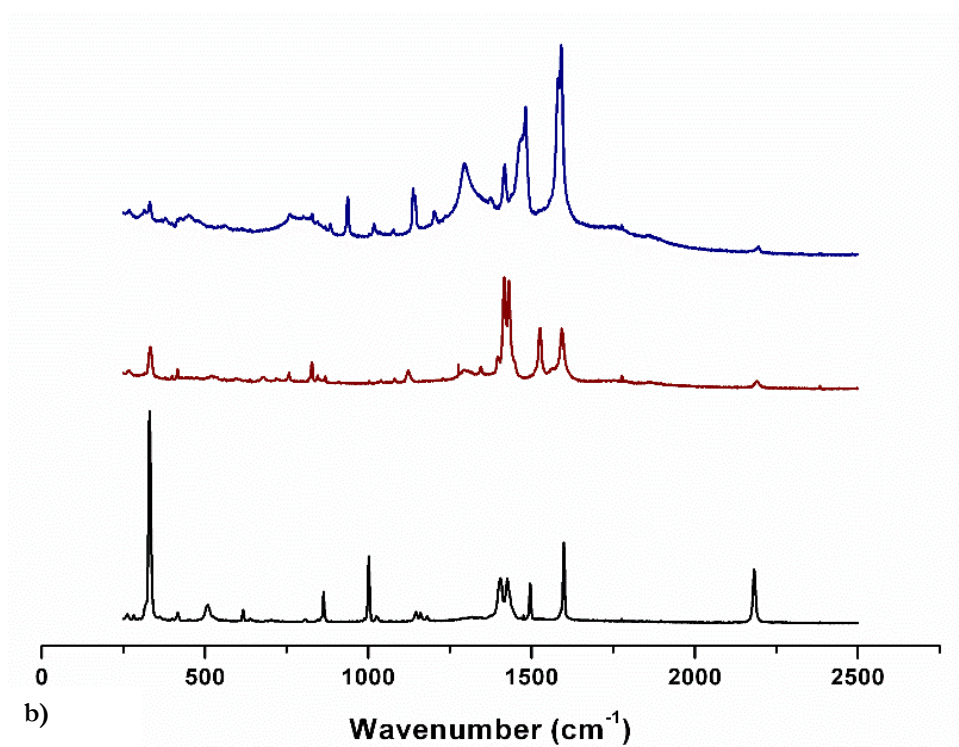
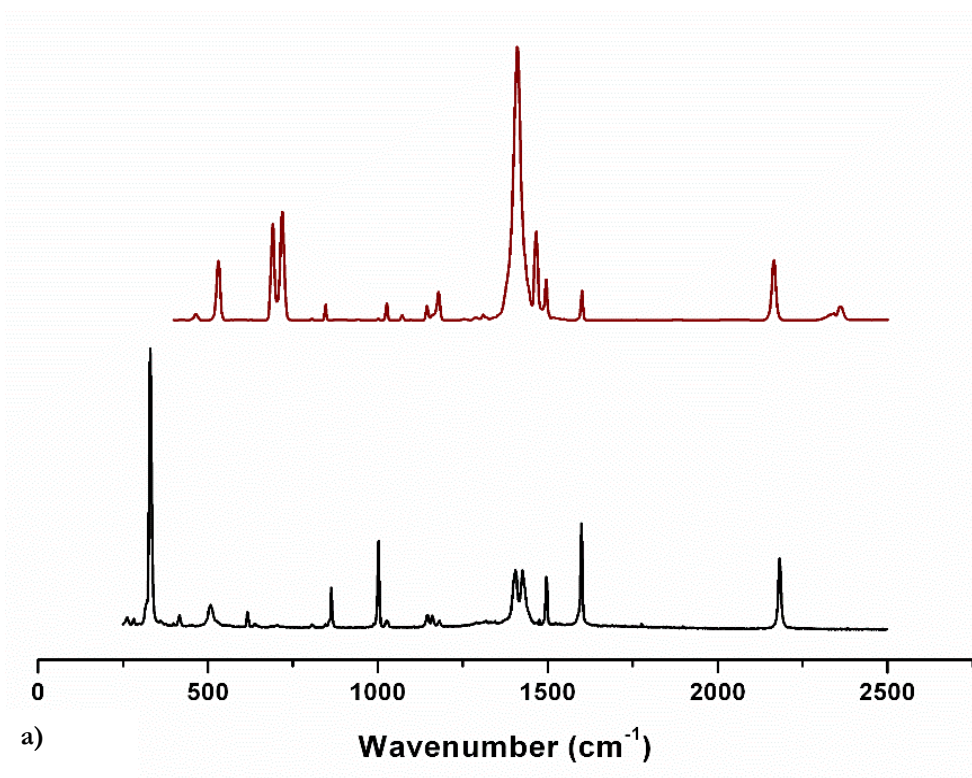


Figure S4. a) FT-IR (red line) and Raman (black line) spectra of **1(Ph)**. b) Raman spectra of **1(Ph)** (black), **1(Thio)** (red) and **1(Furan)** (blue).

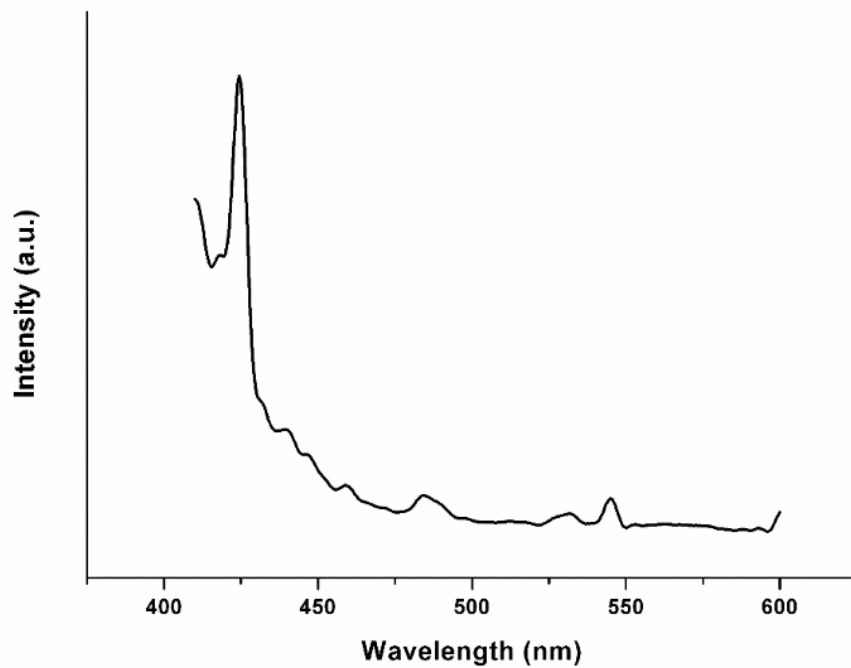


Figure S5. Solid state luminescence spectrum of **1(Ph)**.

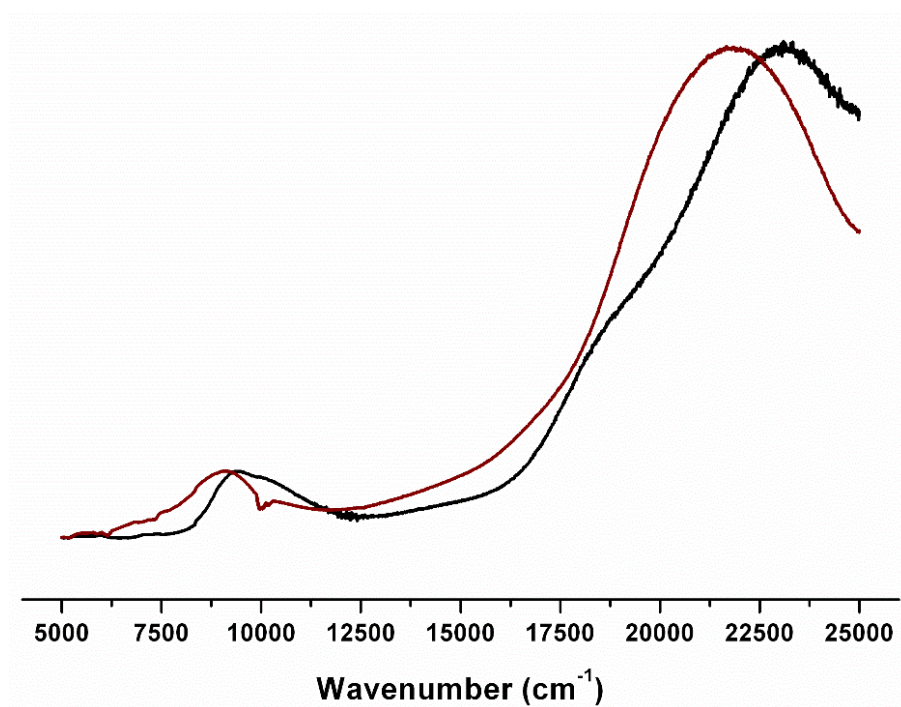


Figure S6. Normalised UV-Vis-NIR spectra of $[\text{Ru}_2(\text{O}_2\text{CPh})_4(\text{THF})_2]\text{BF}_4$ (black line) and **1(Ph)** (red line).

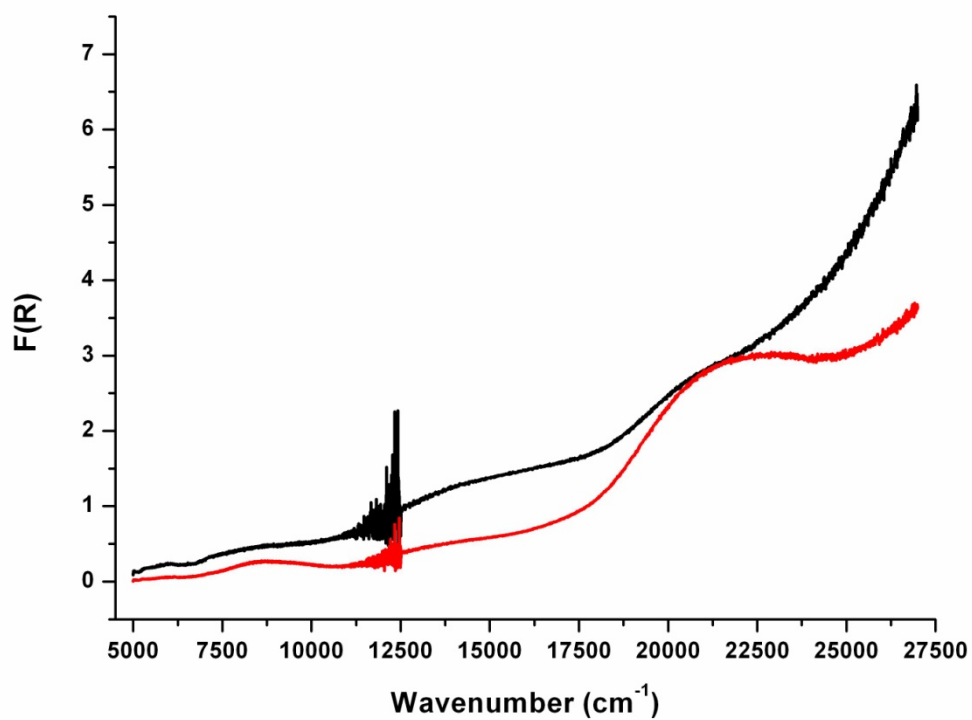


Figure S7. UV-Vis-NIR of **1(Thio)** (black line) and **1(Furan)** (red line). The noise in the region 12000-12500 cm⁻¹ is associated with the NIR to Vis detector changeover.

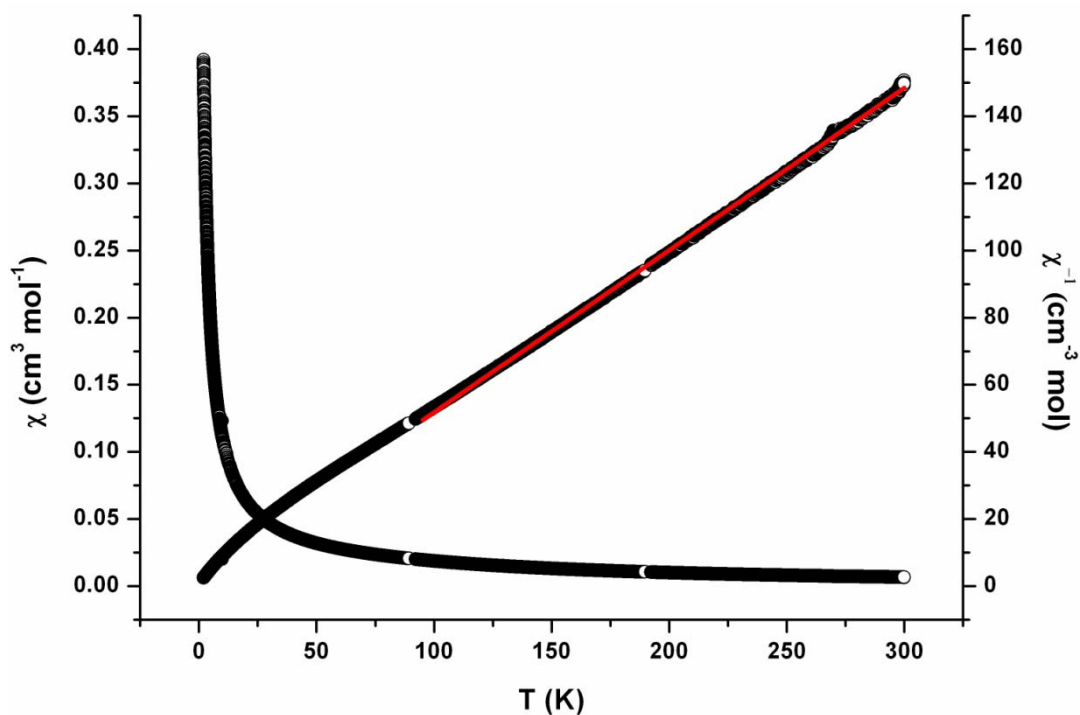


Figure S8. Plots of χ_M and χ_M^{-1} for **1(Ph)**. Curie–Weiss fit for χ^{-1} shown in red. Remeasurement led to a change in magnitude of the small feature at 270 K (which is present also in the data for the other compounds), indicating that it is an artefact of the measurement.

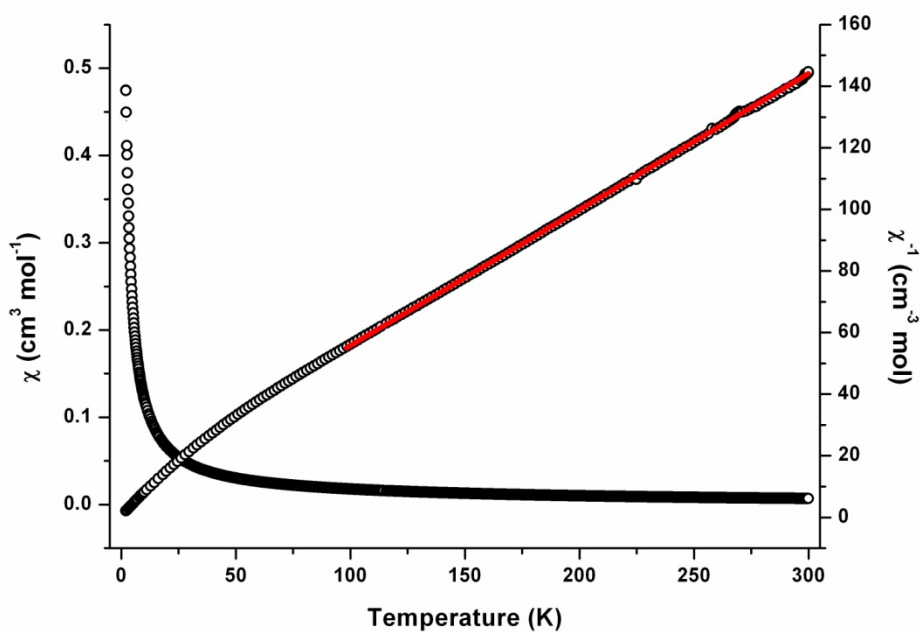


Figure S9. a) Plots of χ_M and χ_M^{-1} for **1(Thio)**. Curie–Weiss fit for χ^{-1} shown in red.

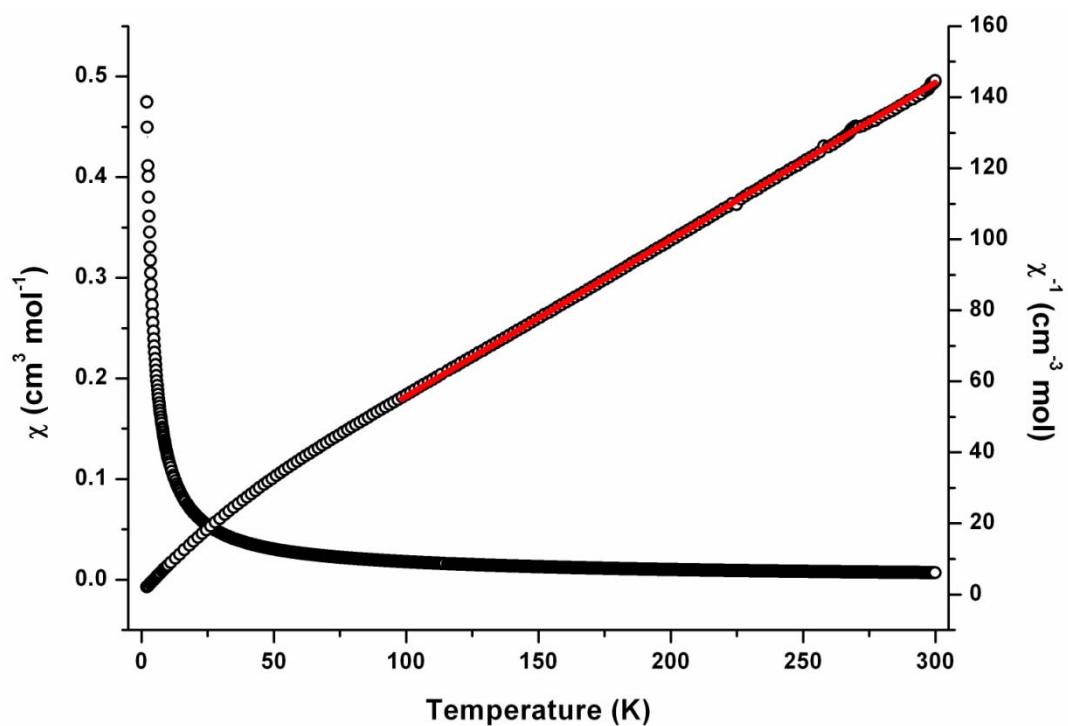


Figure S10. a) Plots of χ_M and χ_M^{-1} for **1(Furan)**. Curie–Weiss fit for χ^{-1} shown in red.

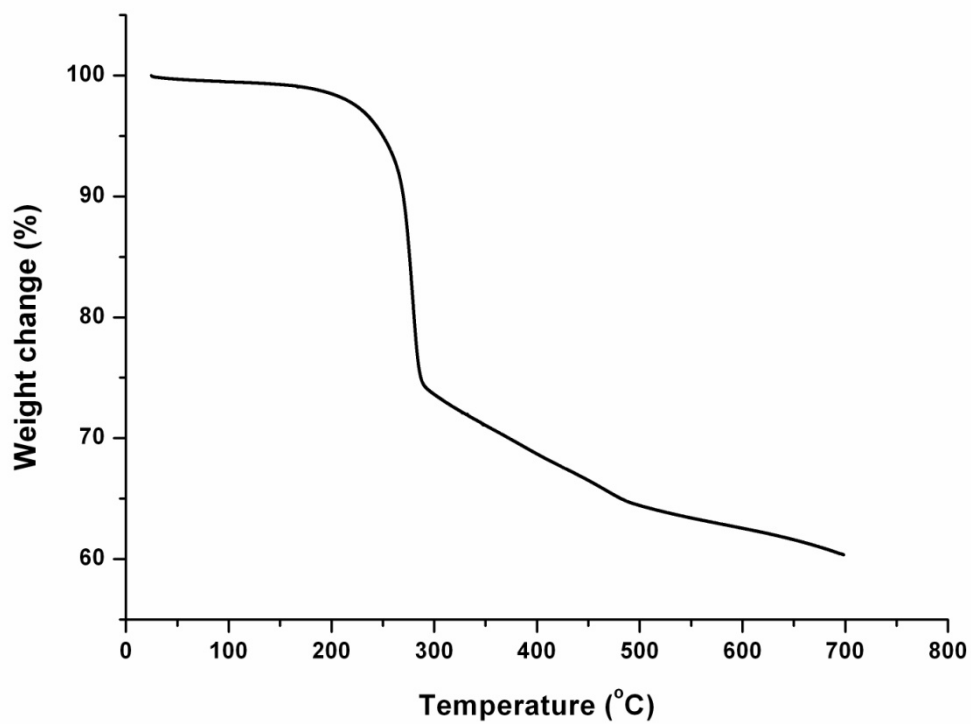


Figure S11. Thermogravimetric analysis of **1(Furan)**.

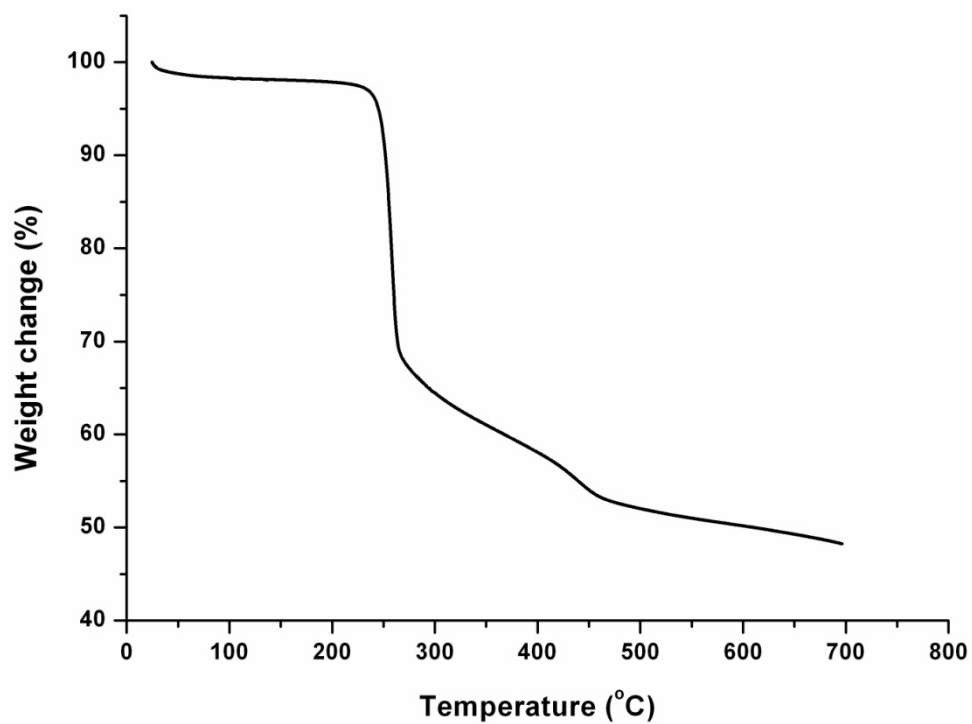


Figure S12. Thermogravimetric analysis of 1(Thio).

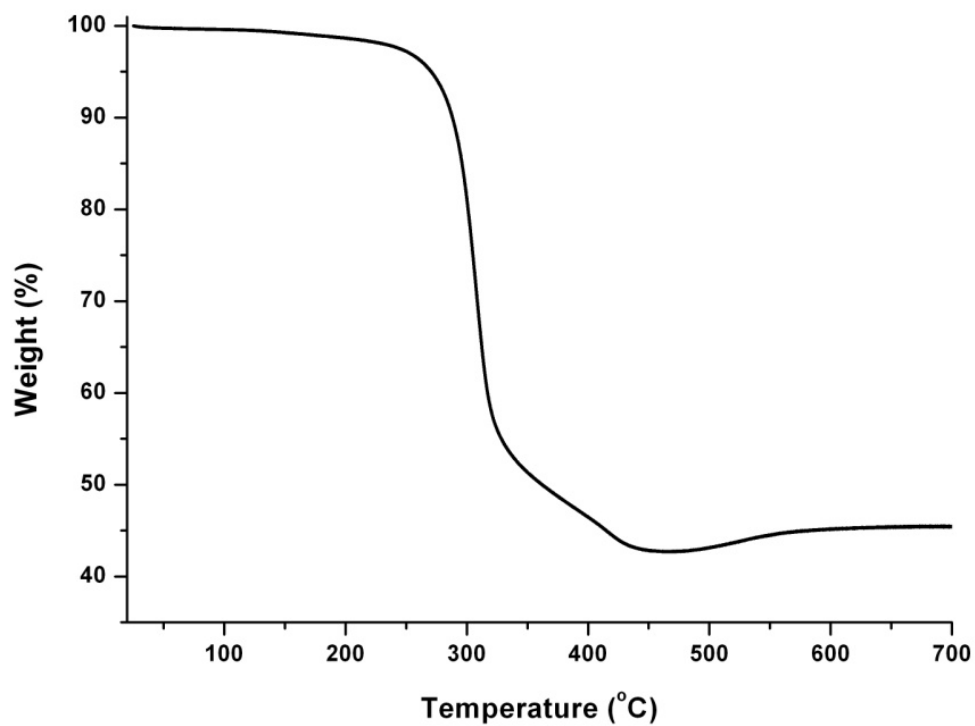


Figure S23. Thermogravimetric analysis of 1(Ph).