Supporting Information

Dinuclear Aluminum Complex as an Active Material for RRAM Switching Device

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Table S1. Crystal data and structure refinement for Complex 1 (CCDC 2426137).

Identification Code	**1**
Empirical formula	$C_{101}H_{164}Al_2Cl_6N_6O_{21}$
Formula weight	1805.53
Temperature/K	100(2)
Crystal system	triclinic
Space group	P-1
a/Å	16.9763(14)
b/Å	18.1646(18)
c/Å	19.4830(15)
α/°	93.121(3)
β/°	98.030(2)
γ/°	106.488(3)
Volume/Å^3	5676.3(9)
Z	2
ρ_{calc}g/cm^3	1.056
μ/mm^{-1}	0.151
F(000)	1944.0
Crystal size/mm^3	0.28 × 0.23 × 0.2
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	4.244 to 50.7
Index ranges	$-20 \leq h \leq 20$, $-21 \leq k \leq 21$, $-23 \leq l \leq 20$
Reflections collected	35913
Independent reflections	20726 [R_{int} = 0.0272, R_{sigma} = 0.0557]
Data/restraints/parameters	20726/0/1238
Goodness-of-fit on F^2	1.013
Final R indexes [I>=2σ (I)]	R_1 = 0.0966, wR_2 = 0.2350
Final R indexes [all data]	R_1 = 0.1300, wR_2 = 0.2693
Largest diff. peak/hole / e Å^{-3}	0.61/-0.68

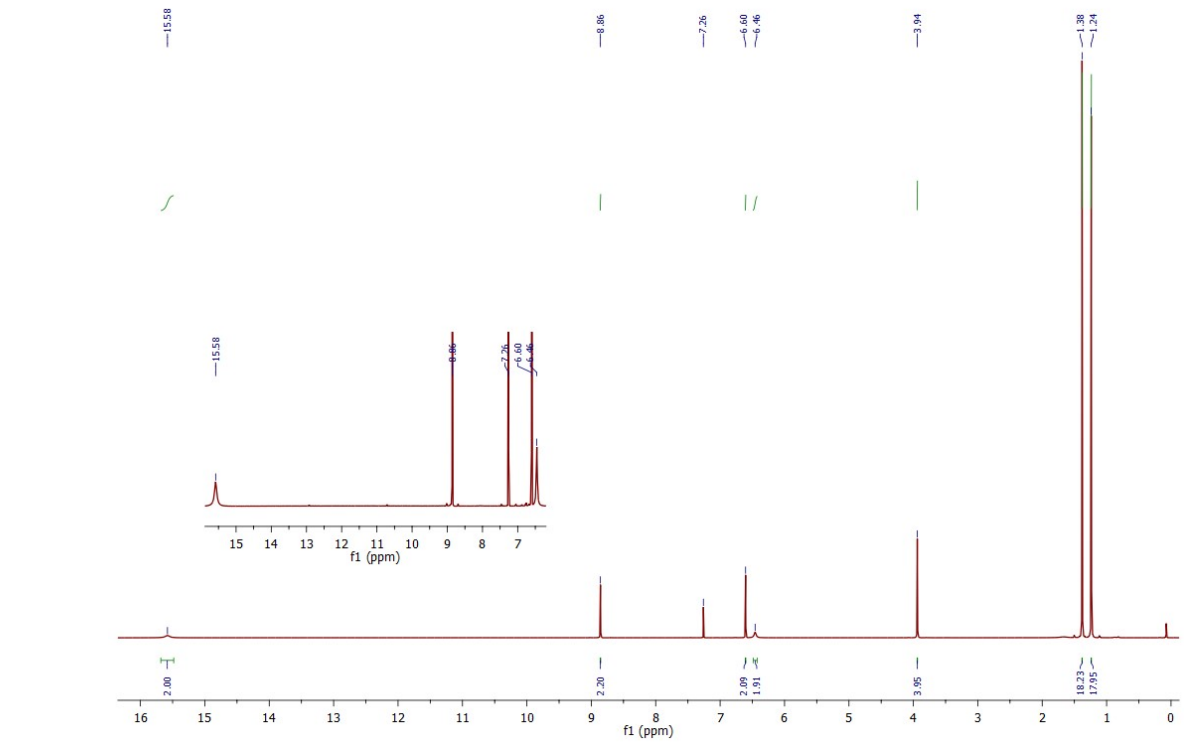


Figure S1. ^{1}H NMR spectrum of Ligand LH_4 in $CDCl_3$.

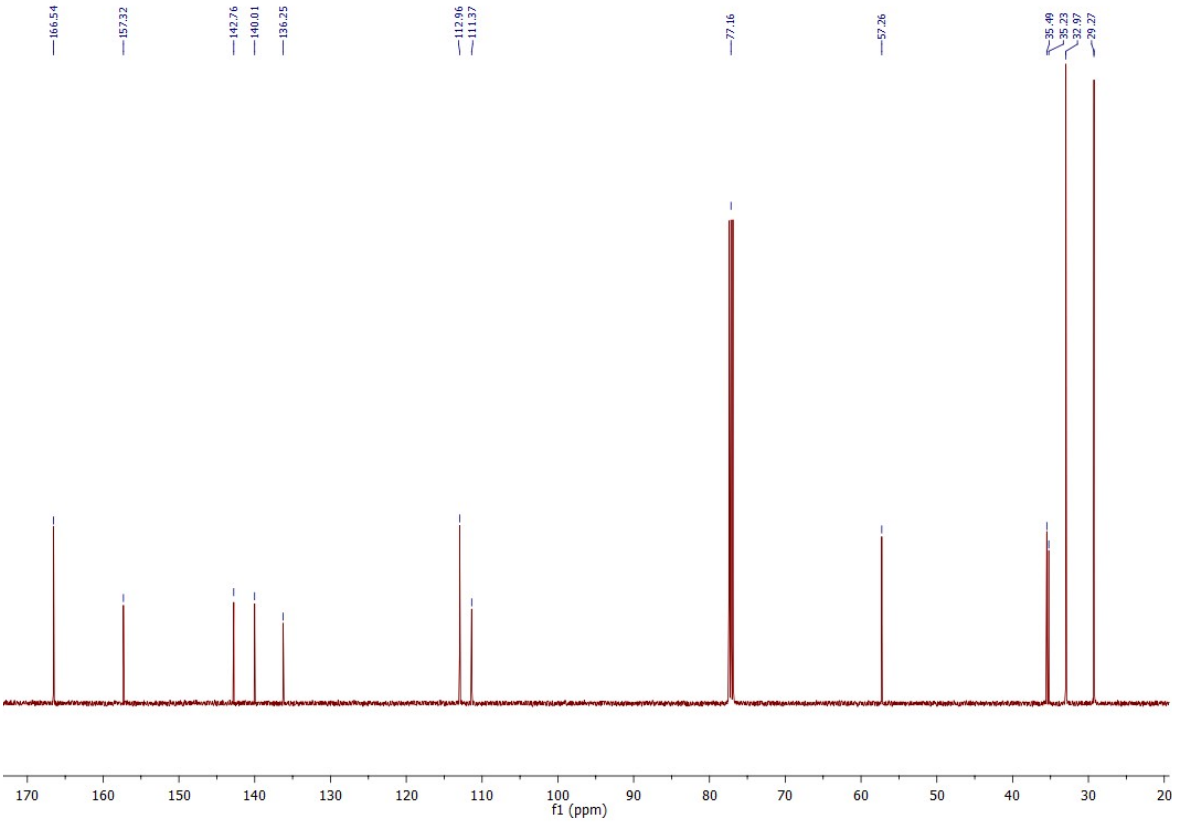


Figure S2. $^{13}C\{^{1}H\}$NMR spectrum of Ligand LH_4 in $CDCl_3$.

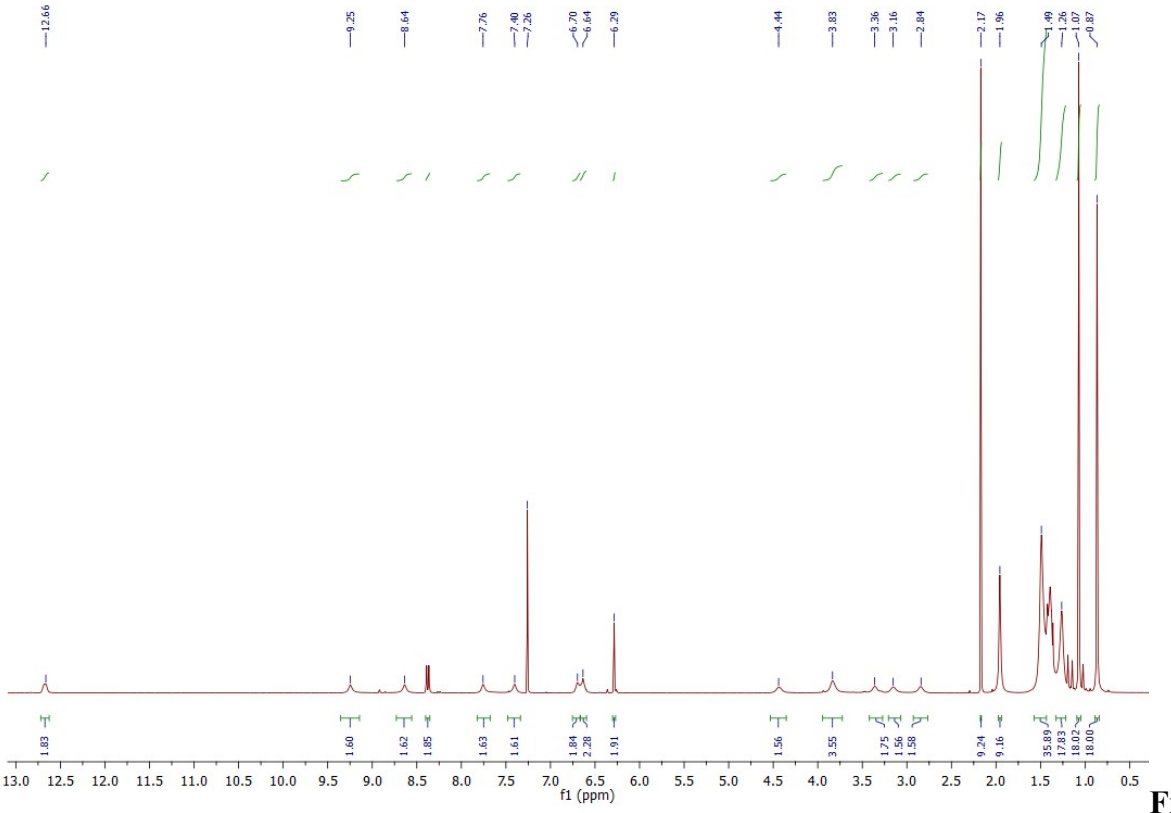


Figure S3. ^{1}H NMR spectrum of Complex **1** in $CDCl_3$**.**

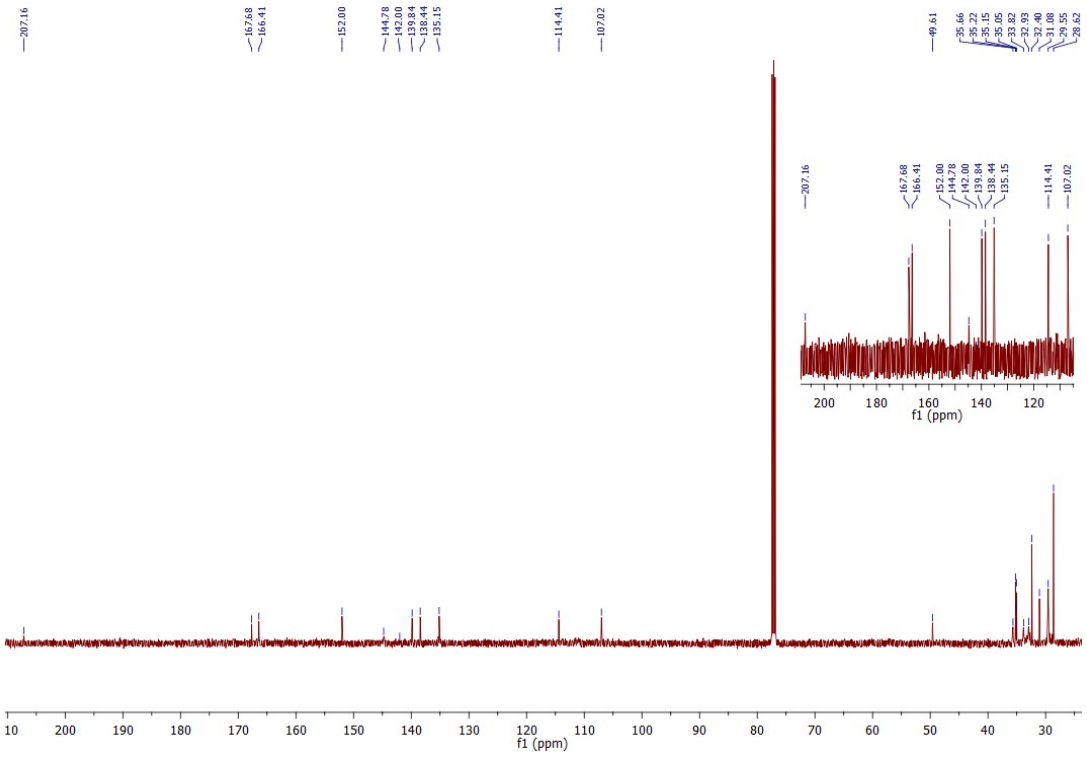


Figure S4. $^{13}C\{^{1}H\}$NMR spectrum of Complex **1** in $CDCl_3$.

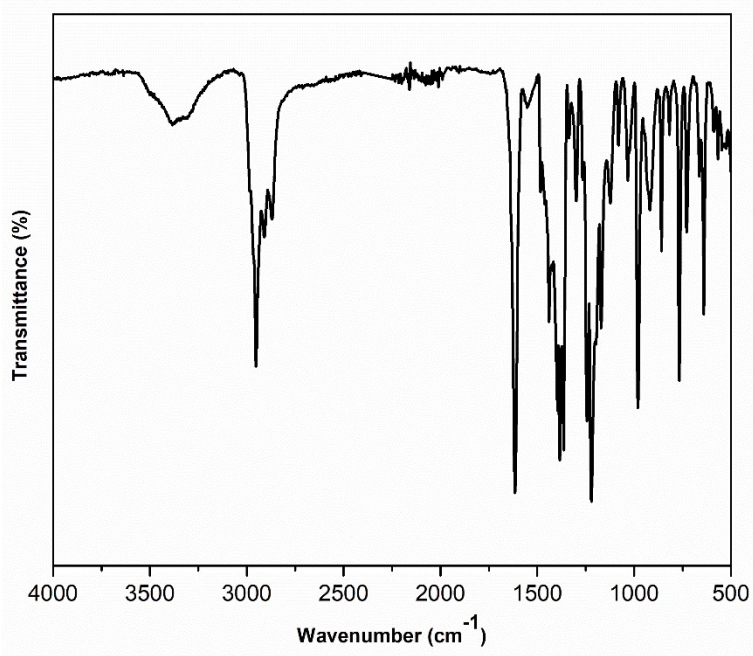


Figure S5. FT-IR Spectrum of Ligand LH_4.

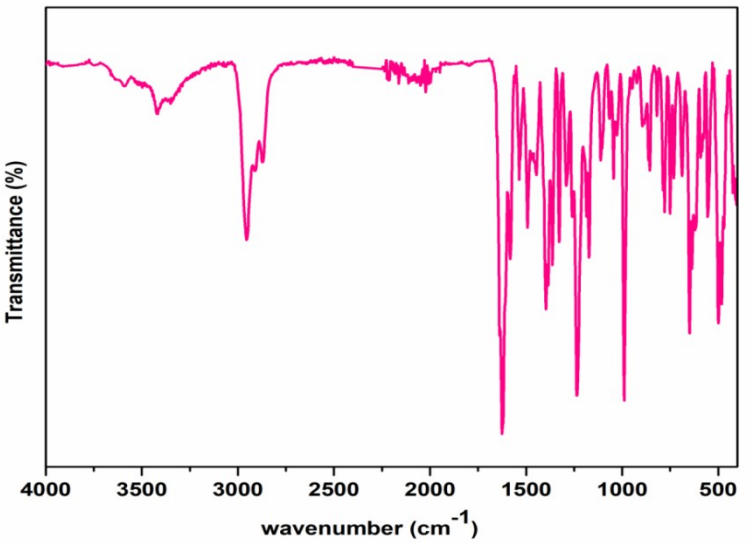


Figure S6. FT-IR Spectrum of Complex **1**.

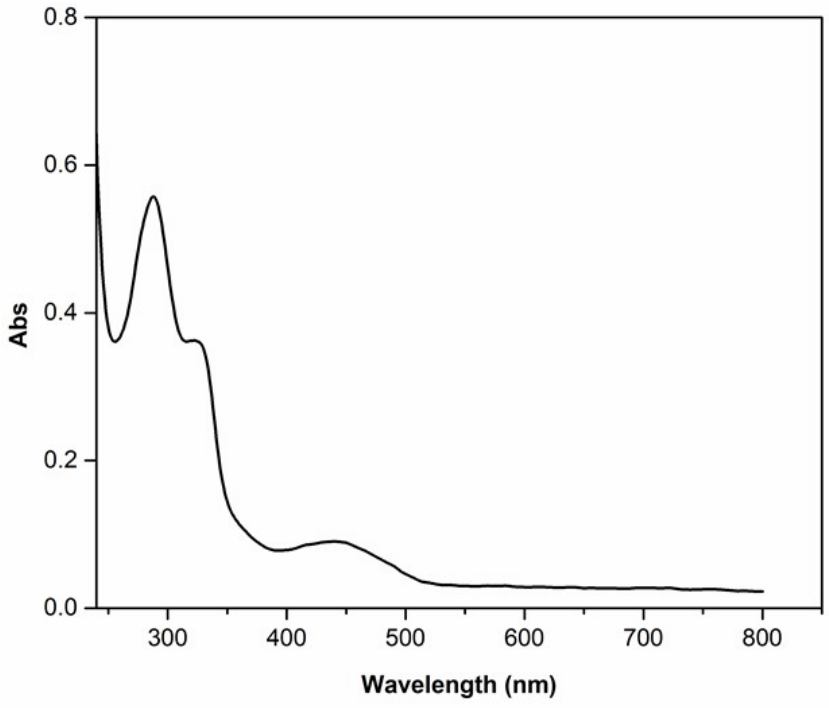


Figure S7. UV-Vis Absorption Spectra of Ligand LH_4 in CH_2Cl_2 (DCM) Solution .

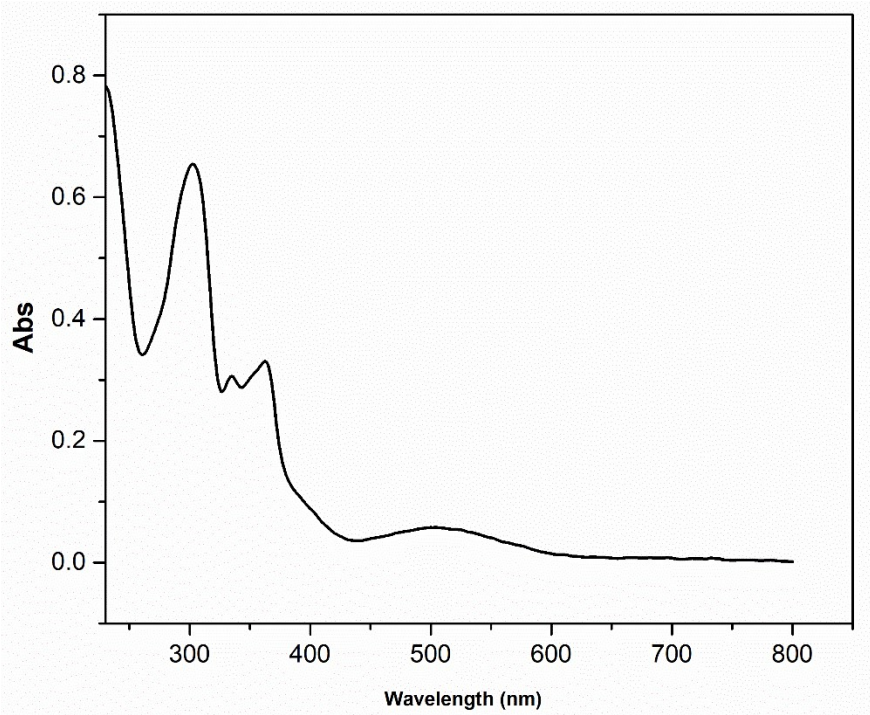


Figure S8. UV-Vis Absorption Spectra of Complex **1** in CH_2Cl_2 (DCM) Solution .

Calculation of Optical band gap E_{opt} using UV-Vis spectrum of complex 1:

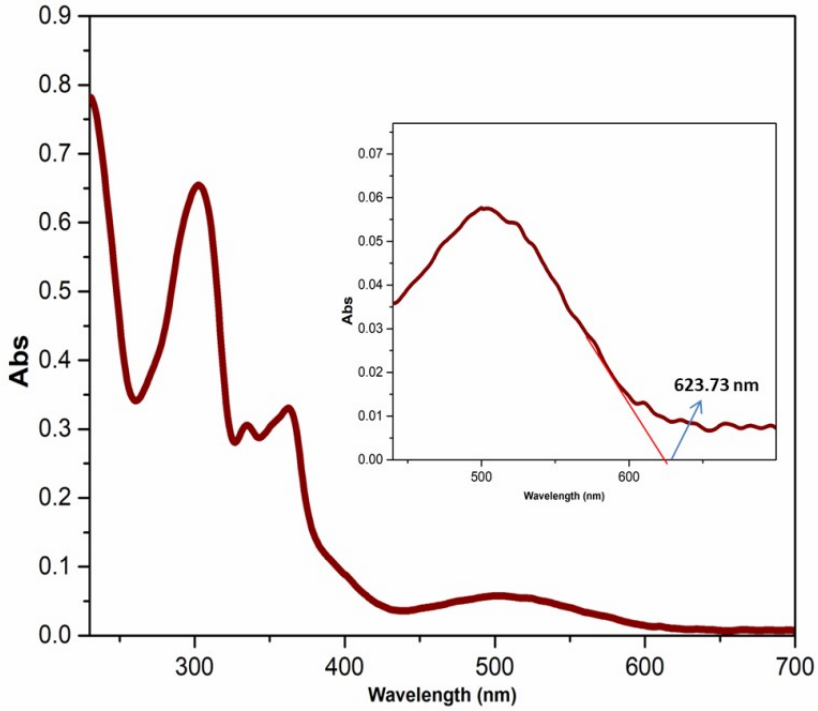


Figure S9. UV-Vis absorption spectrum for the Complex **1** in CH_2Cl_2 (DCM) Solution exhibiting onset optical absorbance.

$$E_{opt} = hc/\lambda_{onset}$$

Where, E_{opt} is the optical band gap of the complex **1**, h is the Planck constant (6.63×10^{-34} m^2kg/s), c is the speed of light (3×10^8 m/s), λ_{onset} is the onset optical absorbance wavelength.

$$E_{opt}\ (eV) = 1240/\lambda_{onset}\ (nm) = 1240/623.73 = 1.98\ eV$$

Calculation of molecular orbital energy levels using electrochemical studies and E_{opt}, optical band gap of complex 1:

$$E_{HOMO} = -[E_{ox,onset} - E_{ox,\,Fc}] - 4.8\ eV$$

$$E_{LUMO} = E_{HOMO} + E_{opt}$$

Where E_{opt} is the optical band gap of the complex **1**, E_{HOMO} and E_{LUMO} are the HOMO and LUMO energy levels, $E_{ox,onset}$ is the onset oxidation potential for the complex **1**, 4.8 eV is the ferrocene reference energy level and $E_{ox,Fc}$ is the potential when ferrocene starts to oxidize (0.40 eV vs. Ag/AgCl).

$$E_{HOMO} = -[-0.13 - 0.40] - 4.8$$

$$= -4.27\ eV$$

$$E_{LUMO} = -4.27 + 1.98 = -2.29\ eV$$

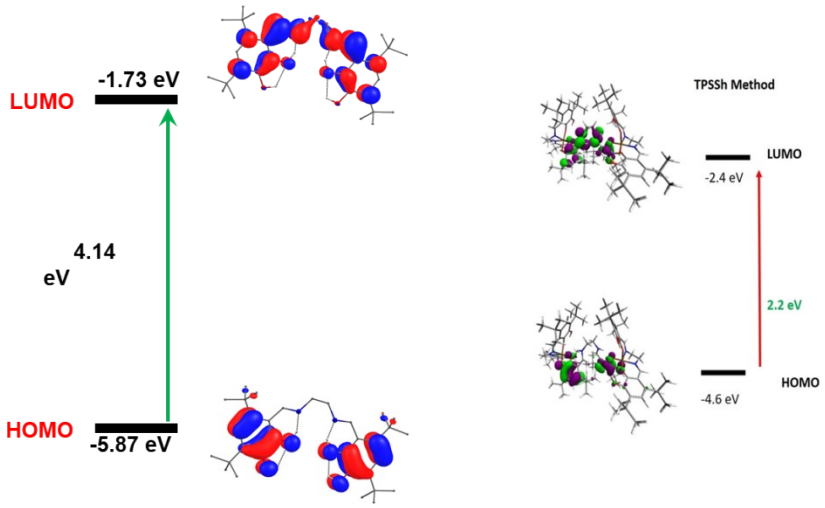


Figure S10. HOMO-LUMO energy gap of the complex **1** and uncoordinated Bis catecholaldimine ligand (LH_4)calculated by DFT.

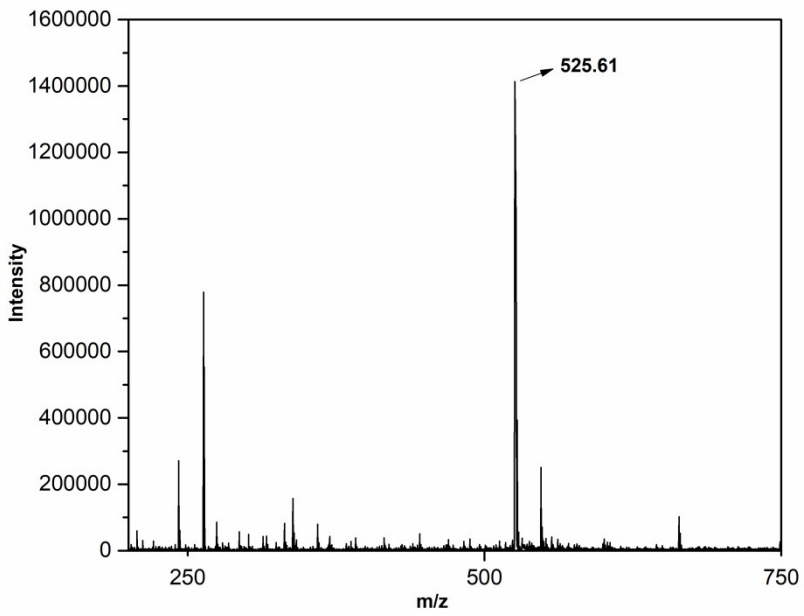


Figure S11. ESI-MS spectrum for LH_4.

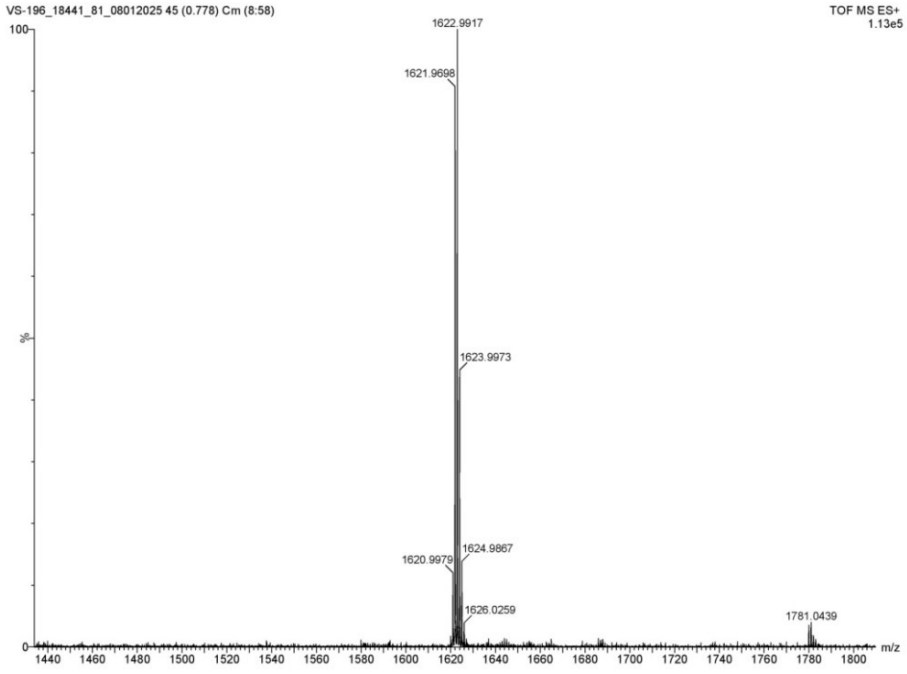
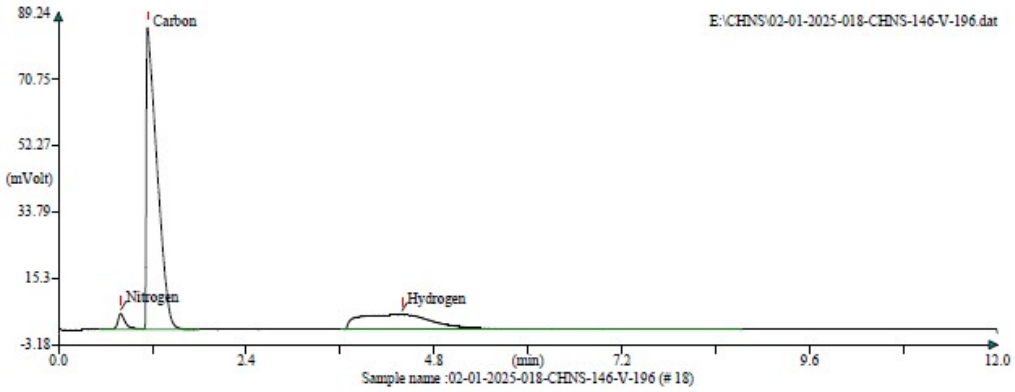


Figure S12. ESI-MS spectrum of Complex **1.**



Peak Number (#)	Retention Time (min)	Area (.1*uV*sec)	Element %	Component Name
1	0.800	296259	4.776	Nitrogen
2	1.142	8031119	59.382	Carbon
3	4.392	2927007	7.631	Hydrogen
		11254380	71.788	

Figure S13: CHN Analysis of Complex **1.**

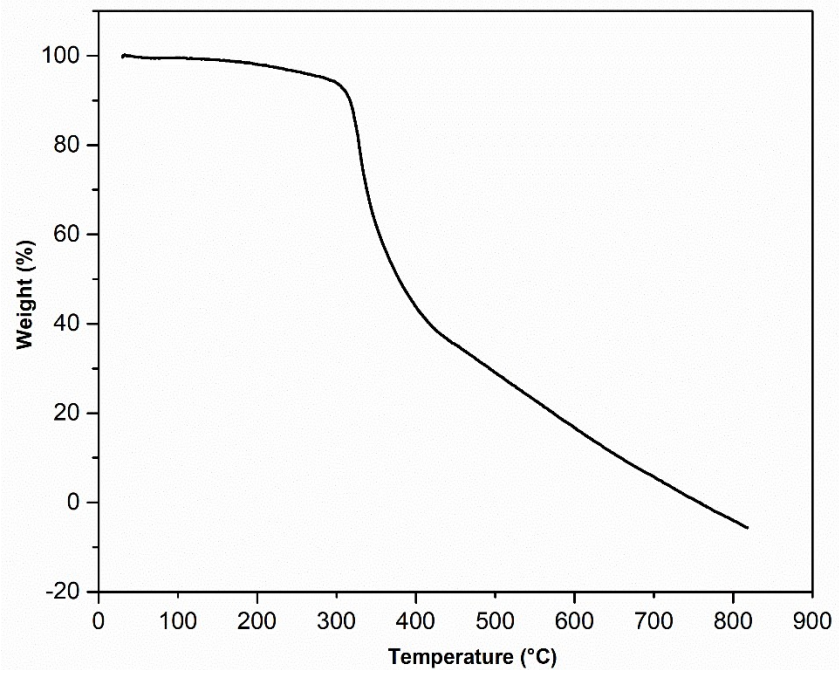


Figure S14: TGA Analysis of Complex **1.** Heating rate = 5^{o}C min−1 under a nitrogen atmosphere.

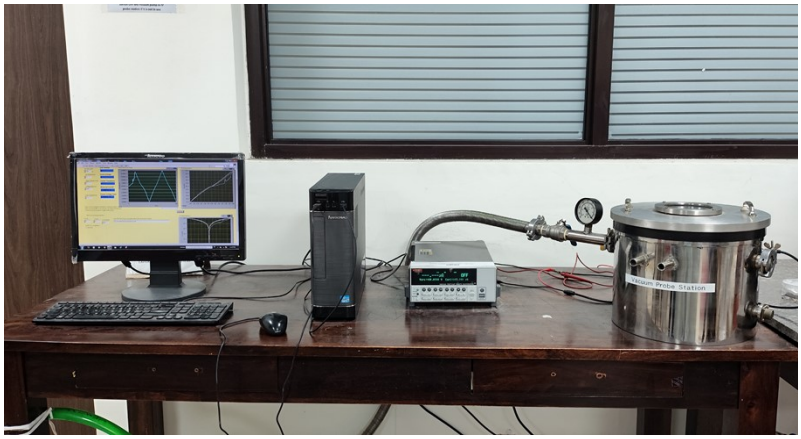


Figure S15: Vacuum probe station

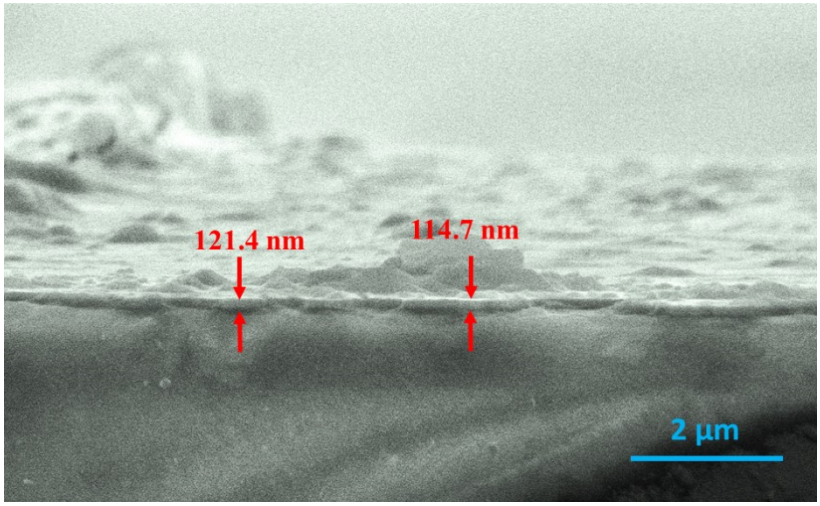


Figure S16. Cross-sectional SEM image of the device ITO/Complex **1**/Ag showing uniformity of the spin coated active layer mentioning thickness in different places of the device which showed 121.4 and 114.7 nm.

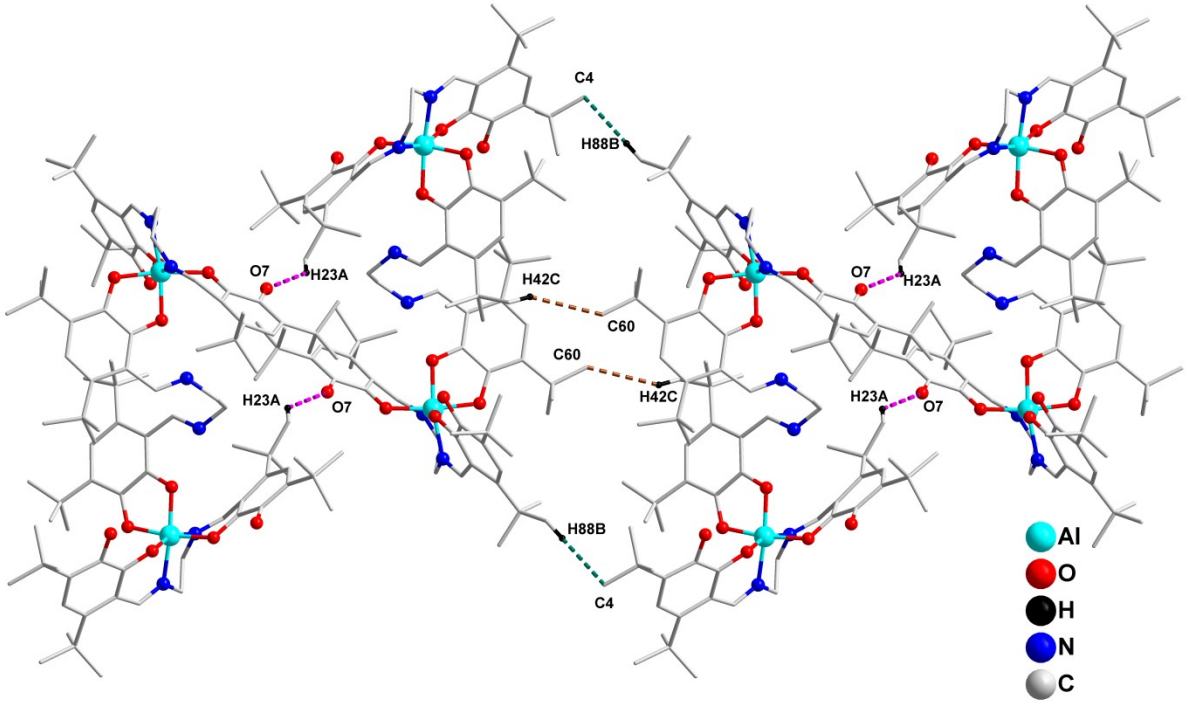


Figure S17: Supramolecular hydrogen bonded C–H···O interactions and C–H···C interactions present together throughout the crystal structure of Complex **1**.