Electronic Supplementary Information

Multifunctional cadmium single source precursor for the selective deposition of CdO or CdS films from a solution route

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Experimental. Elemental microanalyses were performed in the Analytical Laboratories of the University of Catania. ^{1}H NMR spectra were recorded on a Varian Inova 500 spectrometer. Infrared spectra were recorded on a Perkin Elmer FTIR 1720 spectrometer as nujol mulls between NaCl plates. Thermogravimetric analyses were performed by using a Mettler Toledo TGA/SDTA 851^{e}. Weights of the samples were between 10-15 mg (TGA). Analyses were made under prepurified nitrogen using a 5°C/min heating rate.

The ^{1}H NMR spectrum of the Cd(tta)$_2$•tmed adduct shows a singlet at δ = 6.12 ppm, whose integration accounts for the two protons, one for each tta ring. The multiplets at δ = 7.07, δ = 7.47 and δ = 7.60 represents the resonance of the protons of the tiophene ring. In addition, multiplets at δ = 2.51 and δ = 2.63 represent resonances of the six and four protons, respectively, of the tmed methylic and methylenic groups.

The ^{13}C NMR spectrum of the Cd(TTA)$_2$•tmed adduct shows a singlet at δ = 47.06 and a singlet at δ = 56.82, associated with carbons of the methylic and methylenic groups, respectively, of the

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tmed. Singlet at δ = 90.30 represents the resonance of the alchenic C of the tta ring, while the singlets between δ = 128 and δ = 132 represent the resonances of the carbons of the tiophene ring of the same ligand. The singlet at δ = 147.11 is associated with the resonance of the thiophene carbons linked to the carbonilic groups, while the quartet at δ = 119.89 (^{1}J =286.2 Hz) is associated with the resonance of carbons of the -CF_3 groups. Finally, the singlet at δ =185.27 and the quartet at δ = 173.04 (^{2}J=31.4 Hz) represent resonances of the carbonilic carbons linked, respectively, to the thiophene ring and to the -CF_3 group.

Details of film deposition. Films were deposited through spin coating of a 0.3 M solution of $Cd(tta)_2$•tmed complex on glass or Si substrates. Afterwards the films were treated under different temperatures and atmosphere, reactive using O_2 or inert using N_2. The experimental conditions are summarized in Table S1.

Table S1. Relationship between conditions of thermal treatments and nature of Cd containing films.

Temperature	**Atmosphere**	**Treatment Time**	**Phase nature assessed through XRD**	**Elements of the films detected through EDX**
300-700°C	O_2	1 h	CdO	Cd, O
300-450 °C	N_2	1 h	CdF_2	Cd, F, S
450-550°C	N_2	1 h	CdS, CdF_2	Cd, F, S
550-600 °C	N_2	1 h	CdS	Cd, S

Table S2. Crystal data and structure refinement parameters for $Cd(tta)_2 \cdot tmed$.

Empirical formula	$C_{22}H_{24}CdF_6N_2O_4S_2$
M	670.95
T (K)	293
λ (Å)	0.71069
Crystal system, space group	Monoclinic, $P2_1/c$
Unit cell dimensions (Å, °)	a = 17.582(5)
	b = 8.335(2), β = 92.61(3)
	c = 18.610(7)
Volume ($Å^3$)	2724.4(14)
Z, d_{calc} (g/cm^3)	4, 1.636
μ (mm^{-1})	1.026
F(000)	1344
2θ range for data collection (°)	5-50.
Reflections collected / unique	4804 / 4640 [R(int) = 0.0327]
Data / parameters	4640 / 339
Final R indices [I>2σ(I)]	R1 = 0.0510, wR2 = 0.1414
R indices (all data)	R1 = 0.0553, wR2 = 0.1469

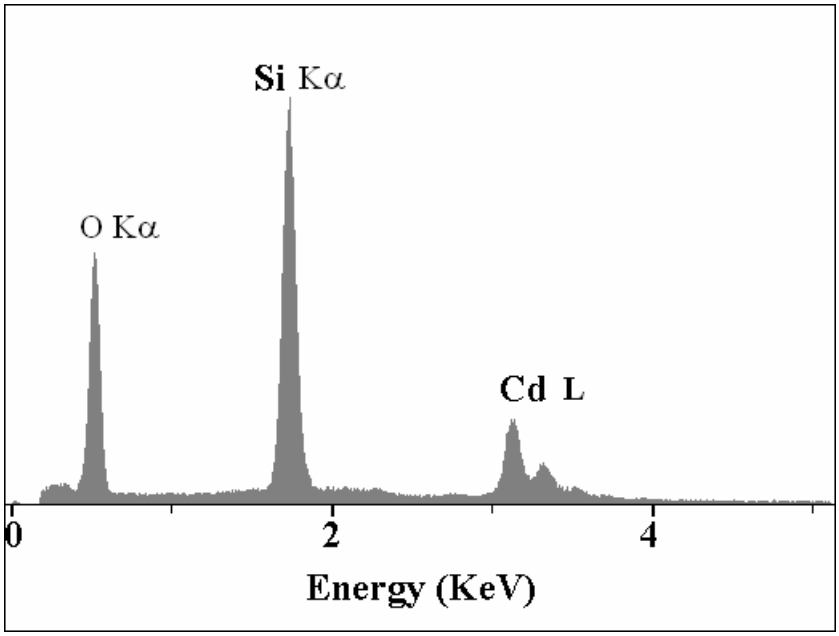
Table S3. Selected bond lengths [Å] and angles [°] for $Cd(tta)_2 \cdot tmed$.

Cd(1)-O(1)	2.284(3)
Cd(1)-O(2)	2.281(3)
Cd(1)-O(3)	2.255(3)
Cd(1)-O(4)	2.258(3)
Cd(1)-N(1)	2.393(4)
Cd(1)-N(2)	2.401(4)

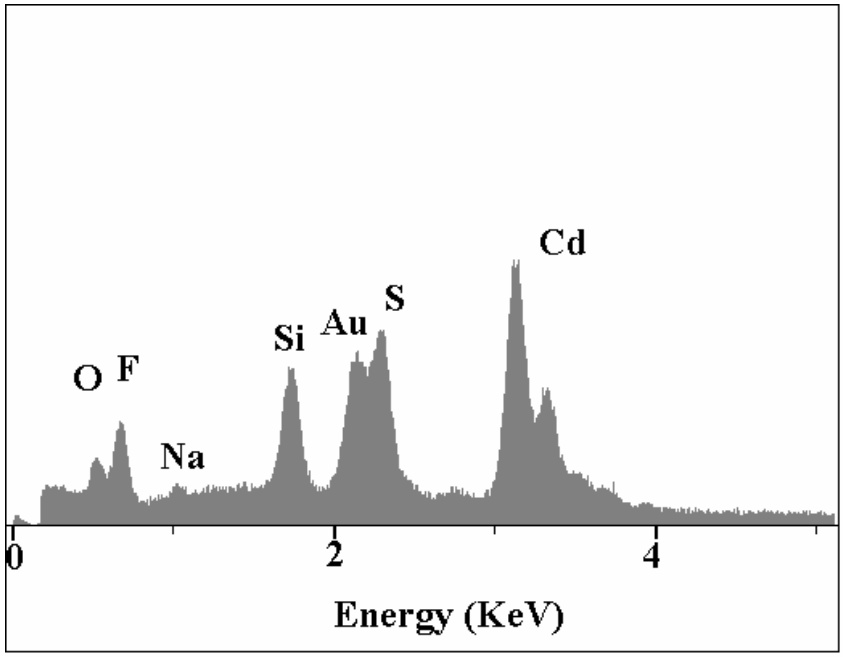
O(1)-Cd(1)-O(2)	79.61(12)
O(1)-Cd(1)-O(3)	97.24(12)
O(1)-Cd(1)-O(4)	167.77(13)
O(1)-Cd(1)-N(1)	94.25(13)
O(1)-Cd(1)-N(2)	97.98(14)
O(2)-Cd(1)-O(3)	103.57(14)
O(2)-Cd(1)-O(4)	88.97(13)
O(2)-Cd(1)-N(1)	165.52(15)
O(2)-Cd(1)-N(2)	90.43(16)
O(3)-Cd(1)-O(4)	81.08(12)
O(3)-Cd(1)-N(1)	90.15(15)
O(3)-Cd(1)-N(2)	160.94(15)
O(4)-Cd(1)-N(1)	97.86(14)
O(4)-Cd(1)-N(2)	86.38(14)
N(1)-Cd(1)-N(2)	77.35(17)

Figure S1. EDX spectra of films obtained under different processing conditions: (a) CdO obtained at 600°C under O_2, (b) CdF_2 obtained at 350°C under N_2, (c) CdS obtained at 600°C under N_2.

(a)



(b)



(c)