Electronic Supplementary Information

Structure, color-tunable luminescence, and UV-vis/NIR benzaldehyde detection of lanthanide coordination polymers based on two fluorinated ligands

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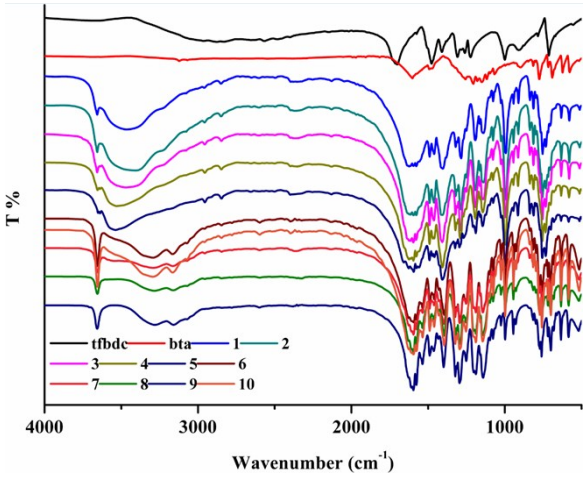

Fig. S1 Infrared spectra of two ligands and complexes **1**–**10**.

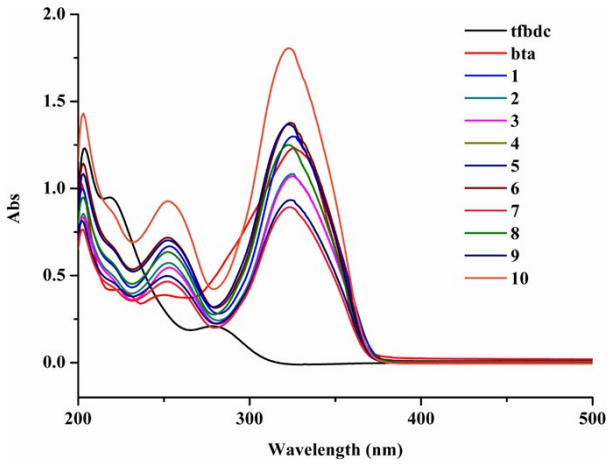

Fig. S2 Ultraviolet spectra of two ligands and complexes **1**–**10.**

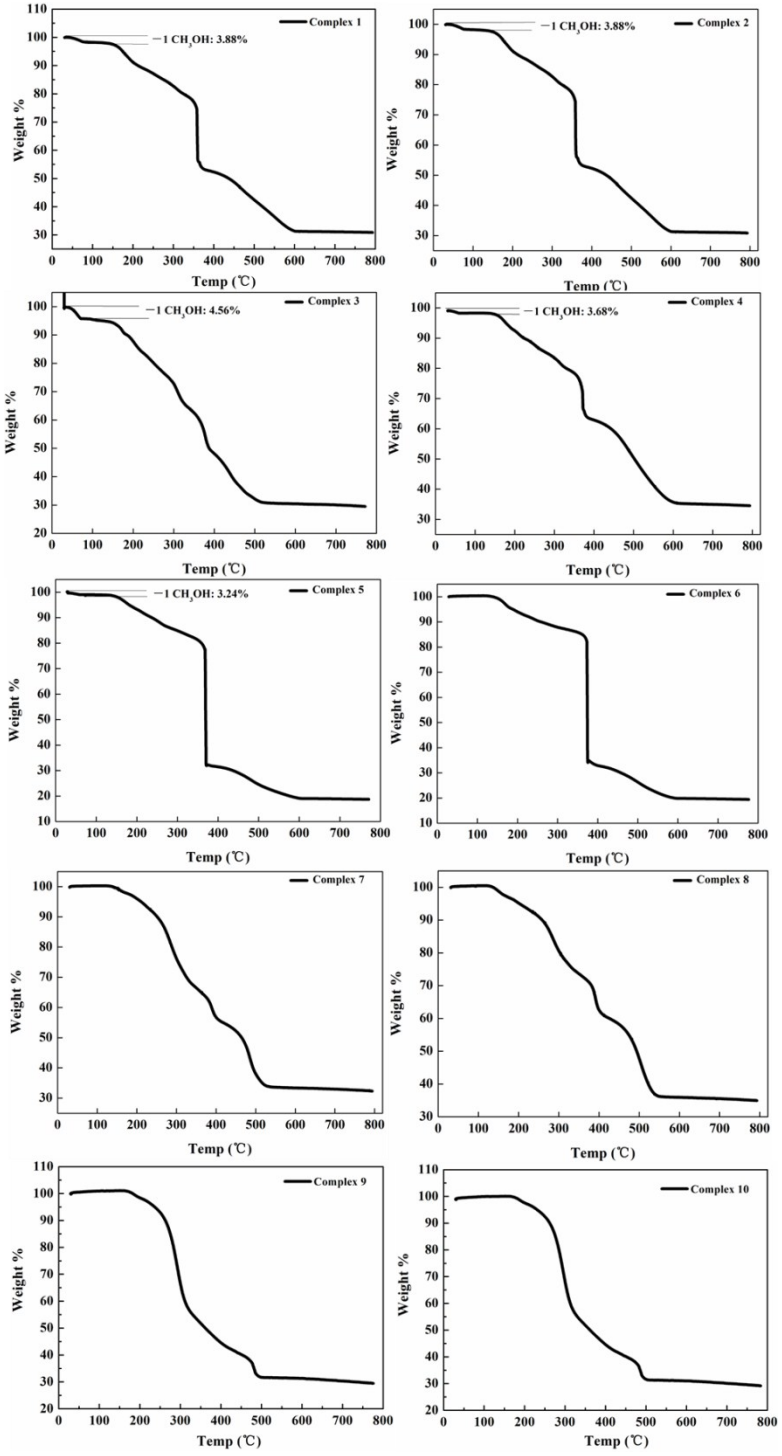

Fig. S3 TG curves of complexes **1**–**10.**

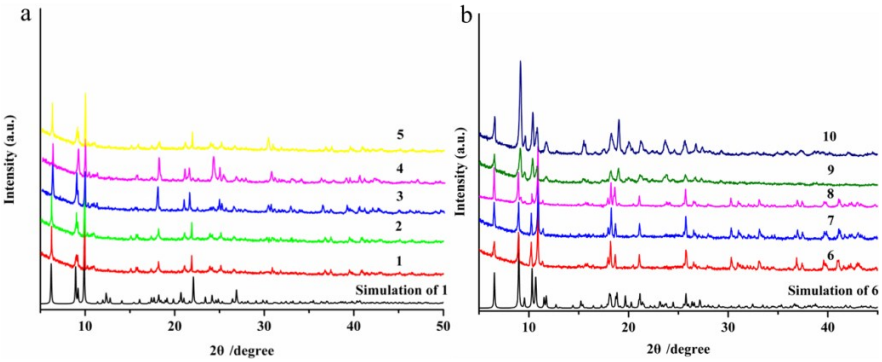

Fig. S4 (a) PXRD patterns of complex **1** simulated from the X-ray single-crystal structure and as-synthesized samples of complexes **1**–**5**. (b) PXRD patterns of complex **6** simulated from the X-ray single-crystal structure and as-synthesized samples of complexes **6**–**10**.

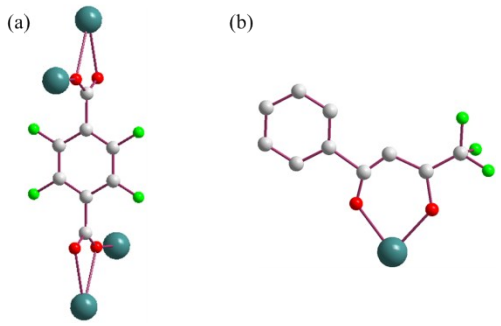

Fig. S5 The coordinating modes of tfbdc (a) and bta (b) in complexes **1**–**10**.

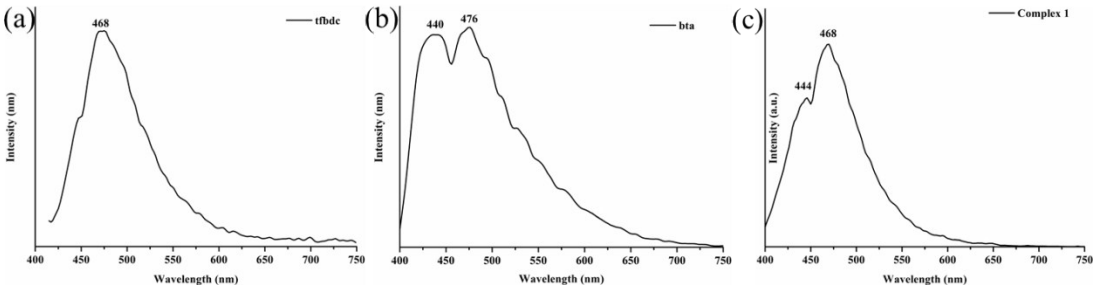

Fig. S6 Solid state emission spectra of two ligands and complexe **1**.

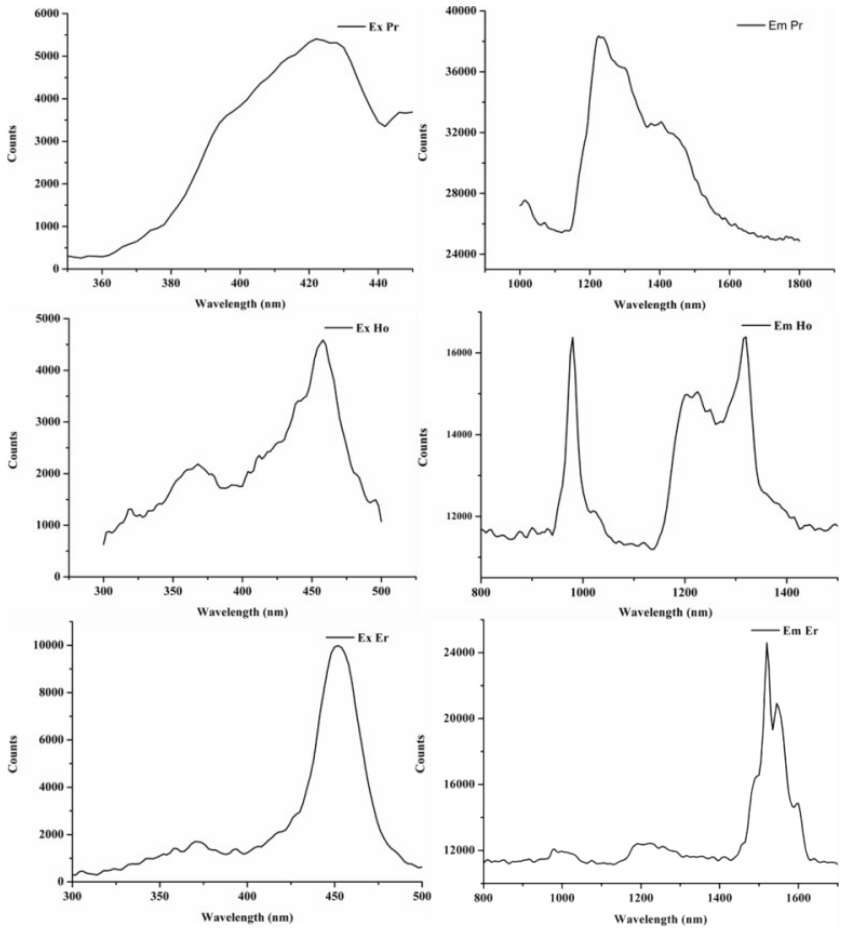

Fig. S7 Solid state excitation (left) and emission (right) spectra of complexes **2**, **8** and **9**.

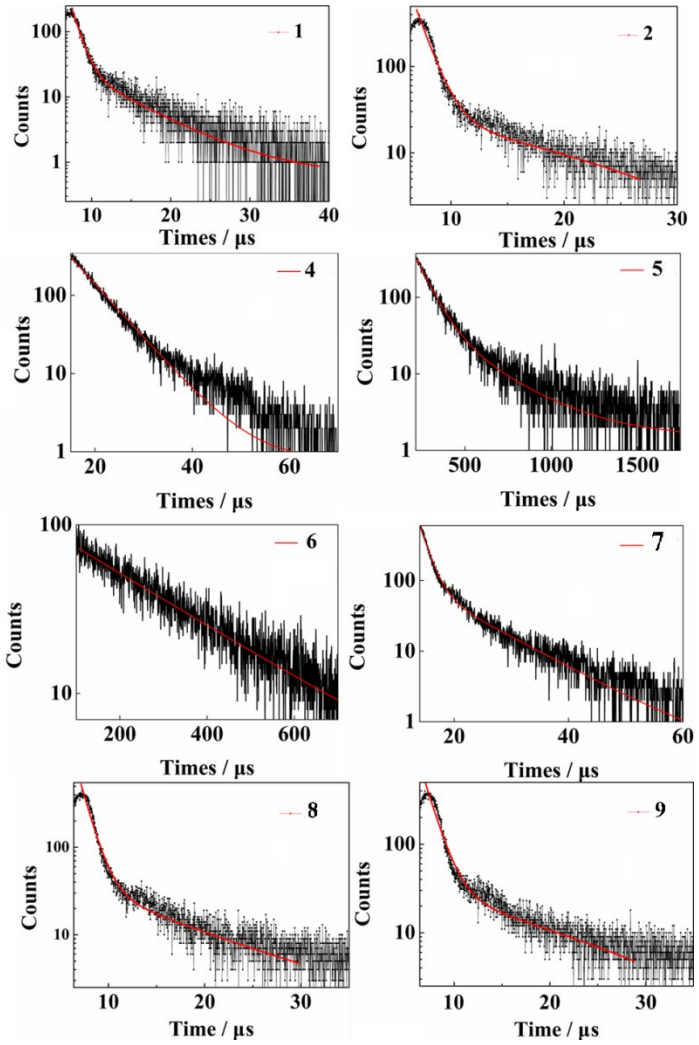

Fig. S8 Room-temperature luminescence decay curves of complexes **1**, **2** and **4**–**9**.

Table S1 Elemental analysis of lanthanide ions by ICP for complex **11**

Comp.	Complex **11**		
	La	Eu	Tb
Wt % (Found)	88.0	2.0	10.0
Mol %	86.3	2.6	11.1

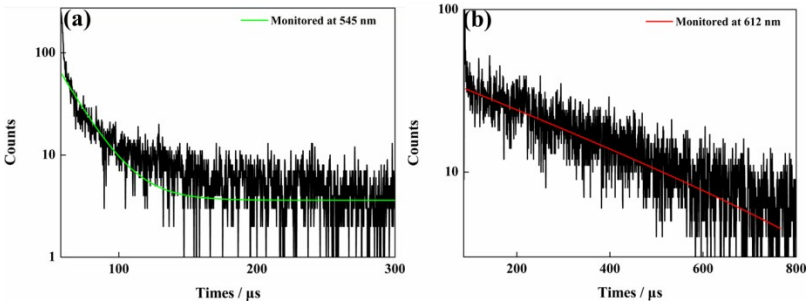

Fig. S9 Room-temperature luminescence decay curves of complex **11** (monitored at 545 and 612 nm).

Table S2 Luminescence lifetime and quantum yield of complexes **1**–**10** and their analogs.

Complexes	τ (μs)	Φ (%)	Complexes[1]	τ (μs)	Φ (%)	Complexes[2]	τ (μs)	Φ (%)
1	0.53;3.14	1.90	-	-	-	-	-	-
2	0.57;8.34	6.80	$Pr(tfbdc)_{1.5}(H_2O)$	10.43	20.57	-	-	-
			$Pr(tfbdc)_{1.5}(H_2O)_2$	2.53	5.00			
3	11.35	4.20	$Nd(tfbdc)_{1.5}(H_2O)$	2.20	0.81	-	-	-
			$Nd(tfbdc)_{1.5}(H_2O)_2$	1.50	0.56			
4	6.31	3.29	$Sm(tfbdc)_{1.5}(H_2O)$	1.61;5.52	0.73	-	-	-
			[2]					
5	159.80	10.17	$Eu(tfbdc)_{1.5}(H_2O)_2$	186.93	10.39	$Eu(tfbdc)(NO_3)(DMF)_2$	-	53.00
						$Eu(tfbdc)(CH_3COO)(FA)$	-	10.00
						[3]		
6	274.10	15.74	$Tb(tfbdc)_{1.5}(H_2O)_2$	916.87	30.56	-	-	-
7	5.20	2.10	$Dy(tfbdc)_{1.5}(H_2O)_2$	1.72;6.73	0.89	-	-	-
8	0.64;3.98	0.56	$Ho(tfbdc)_{1.5}(H_2O)_2$	1.42	0.11	-	-	-
9	0.66;5.90	1.44	$Er(tfbdc)_{1.5}(H_2O)_2$	1.67;7.56	1.79	-	-	-
10	7.94	0.40	$Yb(tfbdc)_{1.5}(H_2O)_2$	1.48;7.21	0.26	-	-	-

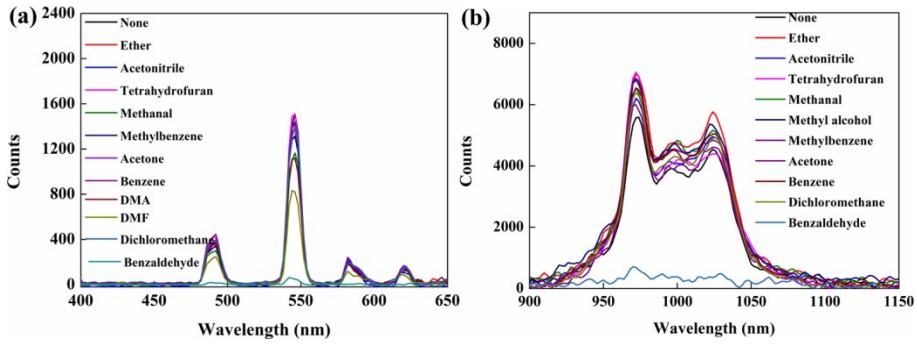

Figure S10 Luminescence of complex **6** (a) and **10** (b) dependence on the various analytes (300 μL) dispersed in ethanol upon excitation at 362 and 360 nm, respectively.

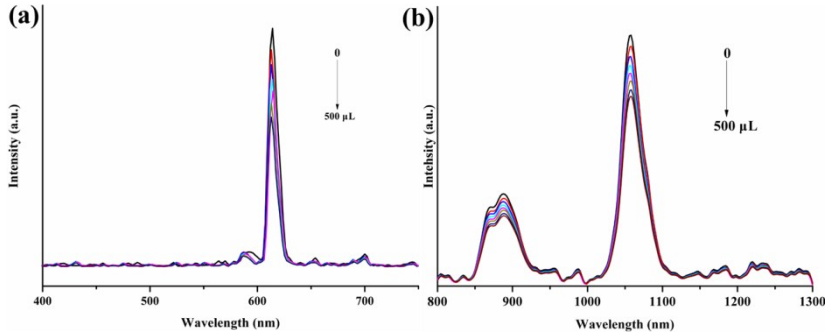

Fig. S11 (a) Luminescence spectra of **5**@EtOH in the presence of various amounts of benzaldehyde from 0 to 500 μL. (b) Luminescence spectra of **3**@EtOH in the presence of various amounts of benzaldehyde from 0 to 500 μL.

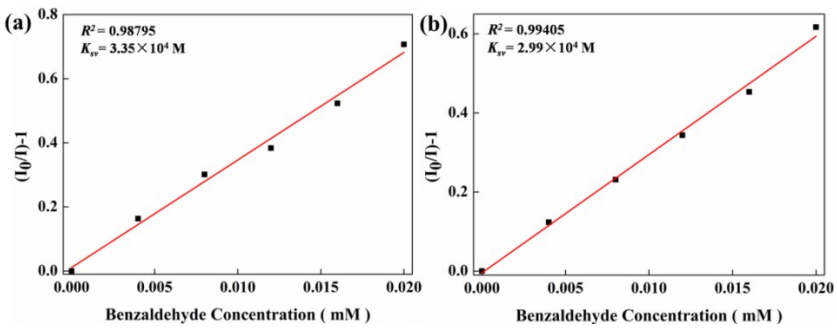

Fig. S12 The Stern-Volmer plots for complexes **6** and **10** with benzaldehyde in the low concentration region. The solid lines represent fits to the concertration-resolved data using the Stern-Volmer equation.

Table S3 Standard Deviation (σ) calculation for complex **6** sensing benzaldehyde.

Test	Fluorescence intensity (nm)
Test 1	1500
Test 2	1492
Test 3	1512
Test 4	1510
Test 5	1492
Standard Deviation (σ)	8.61

Table S4 Standard Deviation (σ) calculation for complex **10** sensing benzaldehyde.

Test	Fluorescence intensity (nm)
Test 1	6916
Test 2	6905
Test 3	6931
Test 4	6922
Test 5	6913
Standard Deviation (σ)	8.73

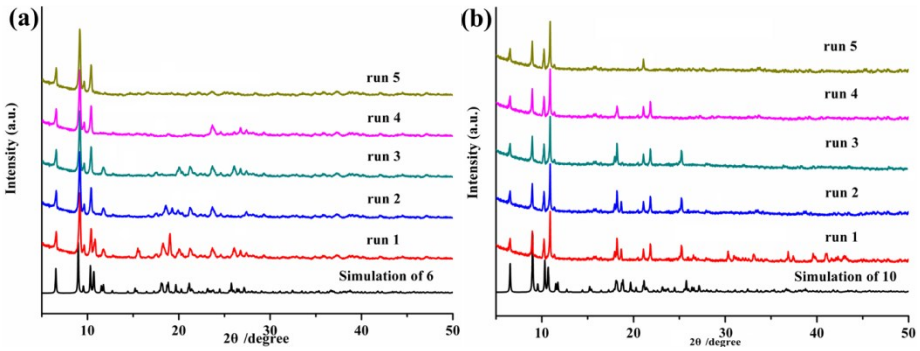

Fig. S13 PXRD patterns of complexes **6** and **10** after detection of benzaldehyde for five cycles.

Table S5 Selected K_{sv} and detection limit for benzaldehyde for complexes **6**, **10** and other materials.

Material	**K_{sv} (M^{-1})**	**Detection limit (mM)**	**Ref.**
$[Sm_2Zn(abtc)_2(H_2O)_4]\cdot 2H_2O$[3]	1.36×10^4	-	3
$[Nd_2(L)_2(DMAC)_2]\cdot nH_2O$[4]	4.90×10^4	3.40×10^{-4}	4
$[Tb(TFBDC)_{1.5}(H_2O)_2]\cdot H_2O$[1]	3.11×10^4	9.01×10^{-4}	1
$[Eu(L)(HCOO)(H_2O)]_n$[5]	1.29×10^3	1.10×10^{-3}	5
$[Tb(L)(HCOO)(H_2O)]_n$[5]	9.88×10^2	1.30×10^{-3}	5
$\{[Tb(L)(H_2O)\ (DMF)]\cdot DMF\}_n$[6]	5.22×10^2	0.54×10^{-3}	6
Complex **6**	3.35×10^4	8.61×10^{-4}	This work
Complex **10**	2.99×10^4	8.64×10^{-4}	This work

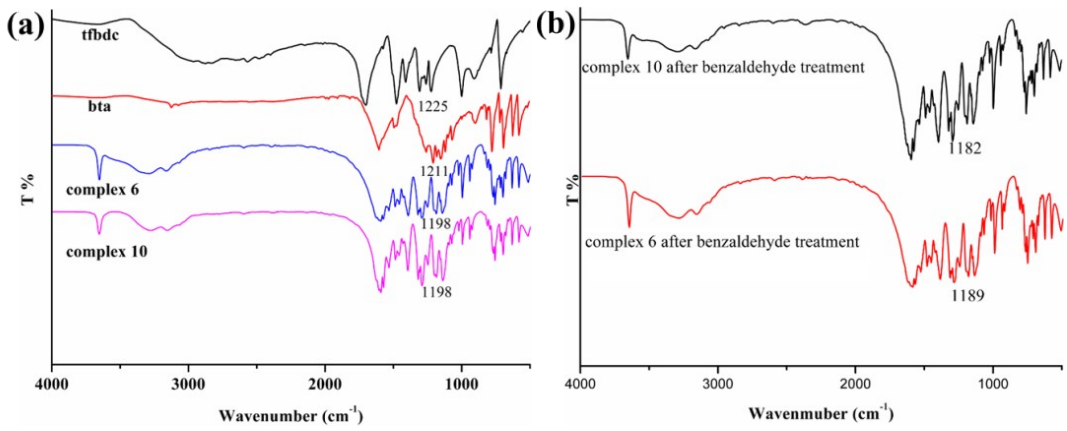

Fig. S14 FT-IR spectra of complexes **6** and **10** before and after treatment with benzaldehyde.

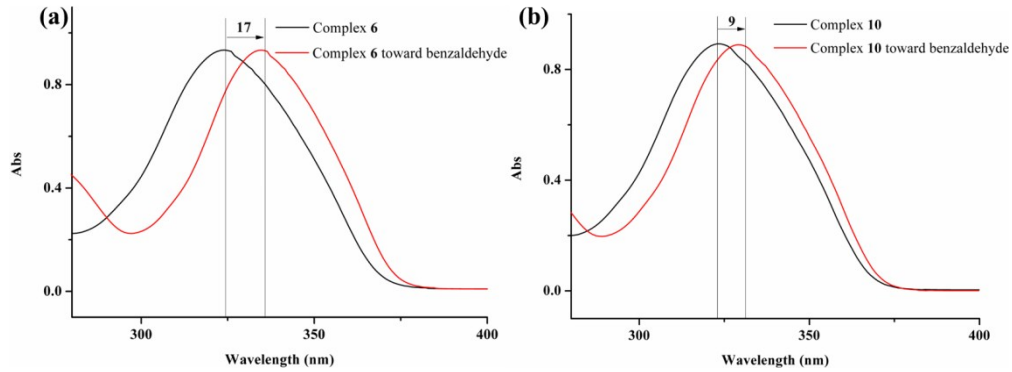

Fig. S15 UV-vis absorption spectra of complexes **6** and **10** before and after treatment with benzaldehyde.

Reference

1. Y. Han, P. Yan, J. Sun, G. An, X. Yao, Y. Li and G. Li, *Dalton transactions*, 2017, **46**, 4642-4653.
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4. X. Wang, P. Yan, Y. Li, G. An, X. Yao and G. Li, *Crystal Growth & Design*, 2017, **17**, 2178-2185.
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