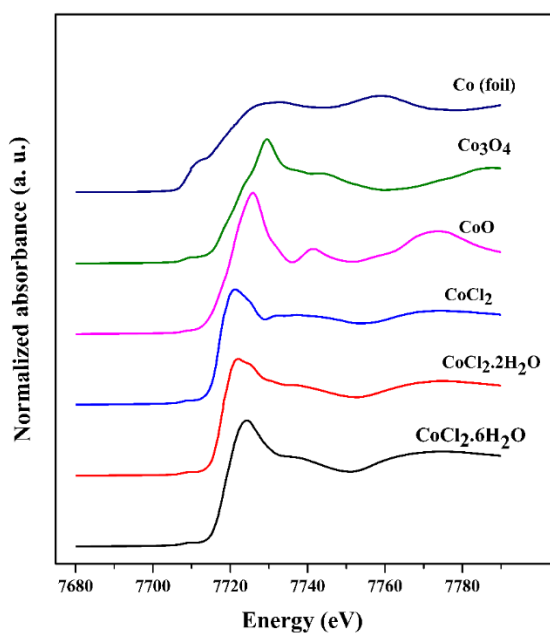
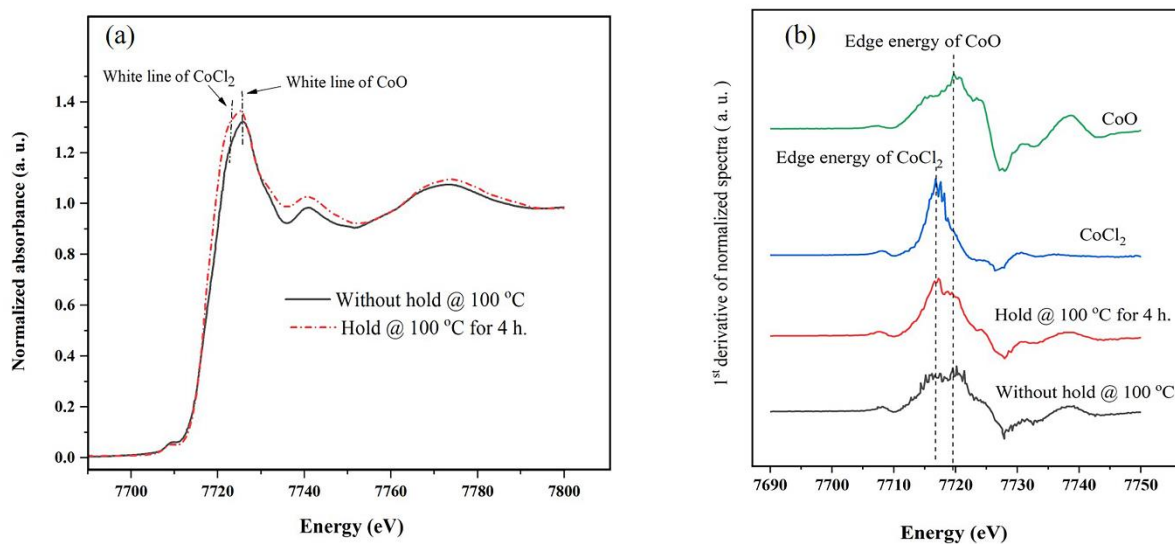


## Supplementary Data



**Figure S1.** XANES spectra of standard materials



**Fig. S2.** Comparison of XANES (a) and first-derivative of normalized spectra (b) of samples treated in N<sub>2</sub> without hold and hold at 100 °C for 4 h, measured at 700 °C.

**Table S1** Co K-edge energy position of the sample as a function of temperature compared to Co metal foil (7709 keV)

sample	K-edge position (eV)	$\Delta E$ (eV)
Standard		
Co foil (neutral state)	7709.0	0
CoO	7718.8	9.8
Co <sub>3</sub> O <sub>4</sub>	7721.6	12.6
CoCl <sub>2</sub>	7717.4	8.3
CoCl <sub>2</sub> · 2 H <sub>2</sub> O	7718.1	9.1
CoCl <sub>2</sub> · 6 H <sub>2</sub> O	7718.2	9.2
Sample treated in N <sub>2</sub> as a function of temperature		
28	7718.2	9.2
50	7718.1	9.1
75	7718.0	9.0
100	7717.7	8.7
150	7717.5	8.5
200	7717.5	8.5
250	7717.5	8.5
300	7717.5	8.5
350	7717.7	8.7
400	7717.9	8.9
425	7718.0	9.0
450	7718.1	9.1
500	7718.3	9.3
550	7728.3	9.3
600	7718.3	9.3
650	7718.3	9.3
700	7718.3	9.3
750	7718.3	9.3
800	7718.3	
Sample treated in N <sub>2</sub> , hold at 100 °C for 4 h as a function of temperature		
28	7718.2	9.2
50	7718.1	9.1
75	7718.0	9.0
100	7717.4	8.4
150	7717.4	8.4
200	7717.4	8.4
250	7717.4	8.4
300	7717.4	8.4
350	7717.6	8.6
400	7717.7	8.7
450	7717.8	8.8
500	7717.8	8.8
550	7717.8	8.8
600	7717.8	8.8
650	7717.8	8.8
700	7717.8	8.8