Supporting Informations

Controllable Organic-Phase Synthesis of Cuboidal CoO Mesocrystals and Their Magnetic Properties

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Characterization of Cobalt oleate Complexes.

Figure S1 presents the FTIR spectra of the COCs; the FIIR of oleic acid is included for comparison. The peak of 1700 cm^{-1} corresponding to the C-O stretching of oleic acid is significantly reduced in the spectrum of COCs, while a new peak centered at 1557 cm^{-1} is formed. This result is consistent with the formation of cobalt carboxylate bonds in the COCs. The COCs spectrum also shows vinyl C-H stretching at 3005 cm^{-1}, indicating that the double bonds in the oleyl groups is remained after the high temperature dissolution. The XRD patterns of the COCs is presented in Figure S2, showing that the COCs has a nearly amorphous structure and a broad basal spacing of 30.03 Å from poorly-ordered layer structures. Moreover, there is no trace of Co_3O_4 precursors. Finally, the elemental analysis revealed the composition of C, 62.86 %; H, 9.47 %, which is close to the formula reported previously ($Co_3(C_{18}H_{33}O_2)_4(OH)_2 \cdot 2H_2O$: C, 63.00 %; H, 10.13 %). The broad band at around 3427 cm^{-1} in FTIR spectrum further confirmed the presence of water and hydroxyl groups in this compound, Figure 1. The

Co 2p XPS spectrum of the COCs was presented in Figure S3. The characteristic peaks at 780.2 (Co $2p_{3/2}$) and 796.2 eV (Co $2p_{1/2}$) and the respective satellite peaks at 784.5 eV and 801.3 eV are typical for the compounds containing Co^{2+}. For comparison, the spectrum of commercial Co(II) stearate was also taken (Figure S3). The two spectra have very similar pattern in the Co 2p range, indicating the Co is in a 2+ valence state.

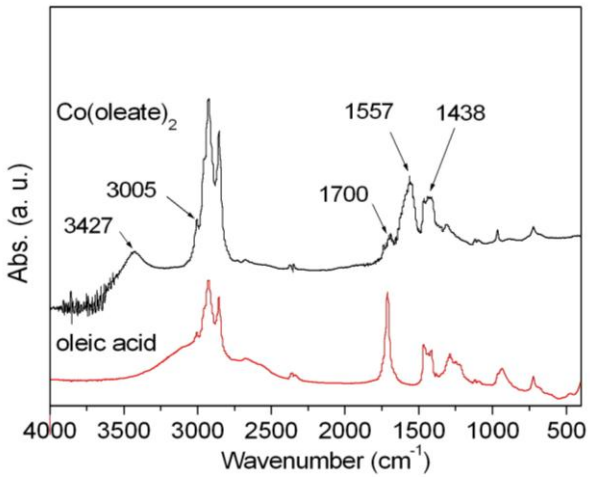

Figure S1 FTIR spectrum of Co-oleate complex produced via dissolution of Co_3O_4 powders in hot oleic acid. Note that the FTIR spectrum of oleic acid is also presented for comparison purposes.

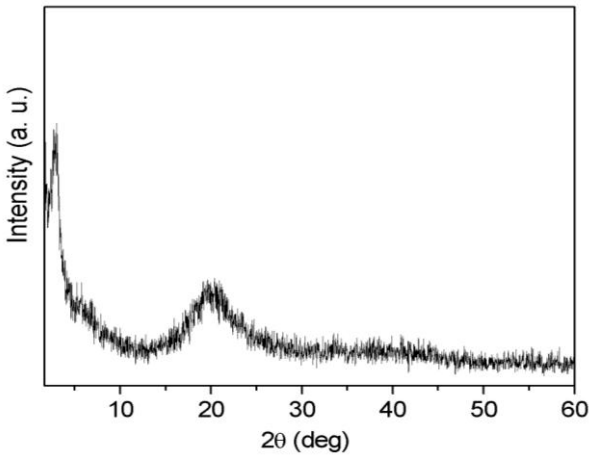

Figure S2 XRD pattern of the as-prepared cobalt-oleate complex showing 3.003 nm basal spacing and poor crystallinity.

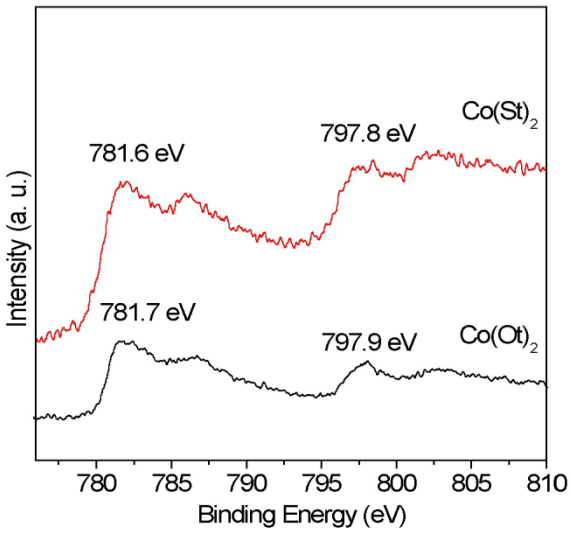

Figure S3. XPS spectra of as-prepared cobalt oleate complex ($Co(Ot)_2$) and commercial cobalt(II) stearate ($Co(St)_2$).

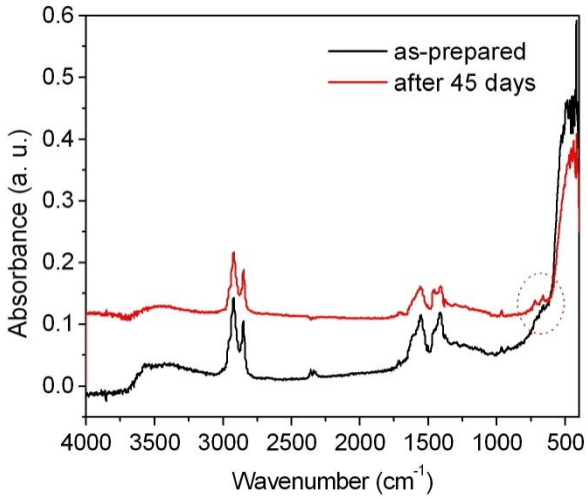

Figure S4. FTIR Spectra of (a) as-prepared and (b) 45-day samples corresponding to run 9 in table 1. The results show the formation of Co_3O_4 in 45-day sample.