

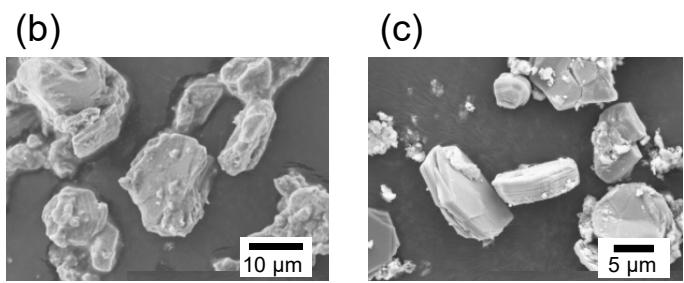
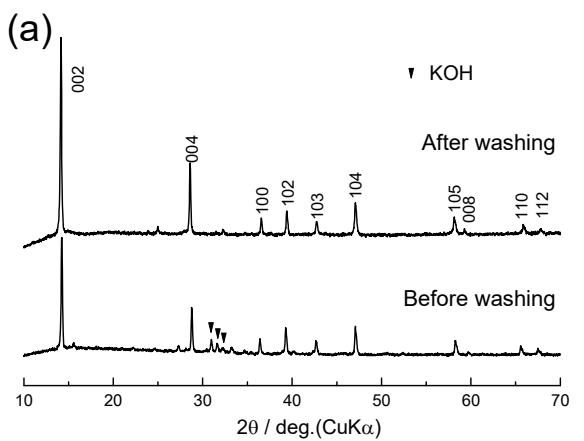
Supporting Information of  
**“P2- and P3-K<sub>x</sub>CoO<sub>2</sub> as Electrochemical  
Potassium Intercalation Host”**

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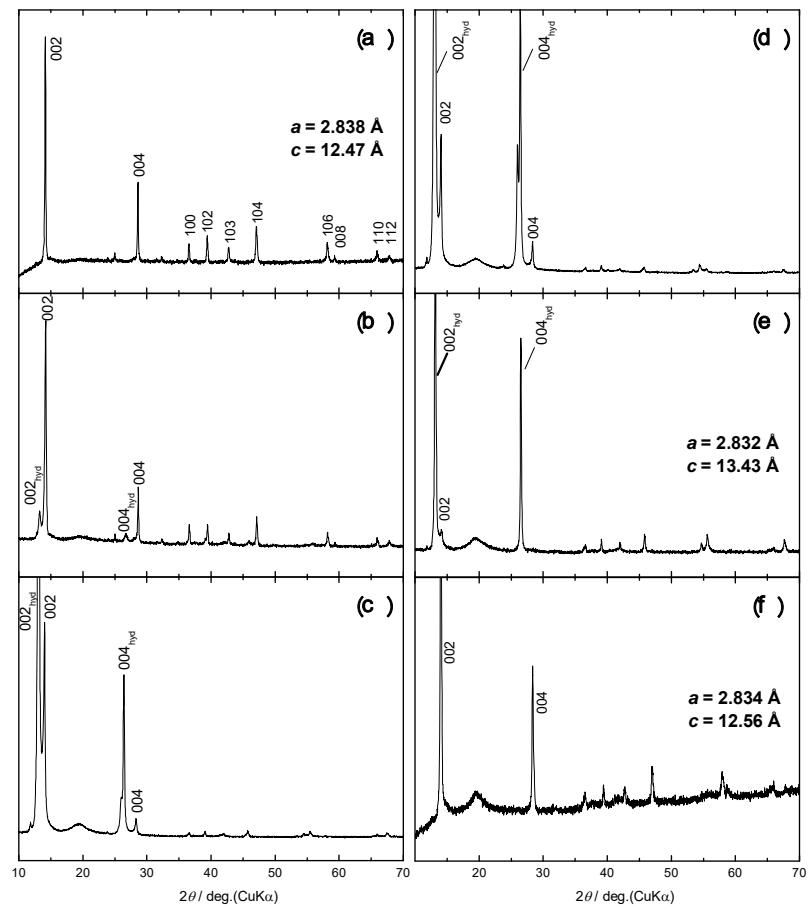
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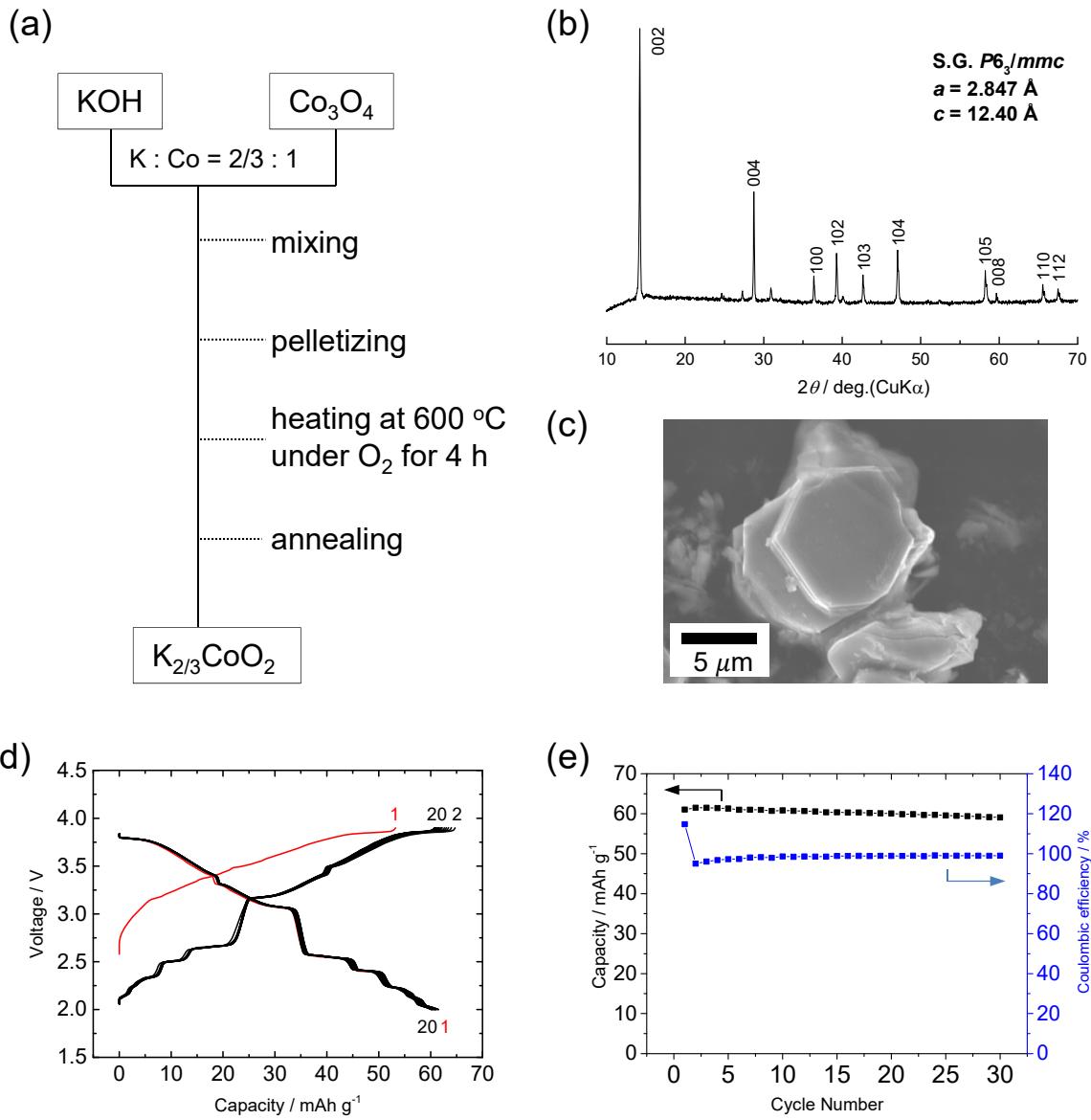


**Fig. S1** (a) XRD patterns of  $\text{K}_x\text{CoO}_2$  before and after washing. SEM images of  $\text{K}_x\text{CoO}_2$  (b) before and (c) after washing.

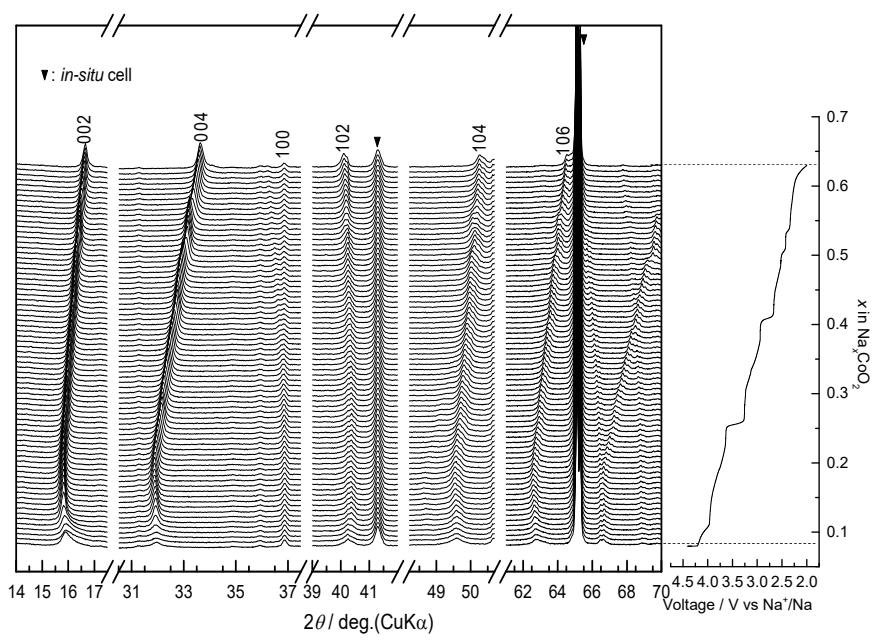


**Fig. S2** XRD patterns of P2- $\text{K}_{0.41}\text{CoO}_2$ ; (a) pristine, after exposure to humid air for (b) 1 h, (c) 1 day, (d) 2 days and subsequent drying (e) at  $80^\circ\text{C}$  for 12 h and (f) at  $150^\circ\text{C}$  for 12 h.

After exposure to humid air, new peaks at about  $13$  and  $27^\circ$  are observed in Figs. S2 b-d and even after drying at  $80^\circ\text{C}$ . These peaks are indexed as  $002_{\text{hyd}}$  and  $004_{\text{hyd}}$  of a hydrated phase. Although the peaks disappear after drying at  $150^\circ\text{C}$ , the lattice parameters are different from those of the pristine sample. These results confirm that P2- $\text{K}_{0.41}\text{CoO}_2$  is sensitive to moisture and the sample has to be handled in Ar atmosphere.



**Fig. S3** (a) Synthesis procedure of  $\text{K}_{2/3}\text{CoO}_2$ . (b) XRD pattern and (c) SEM image of P2- $\text{K}_{2/3}\text{CoO}_2$ . (d) Charge and discharge curves and (e) capacity retention of the K // P2- $\text{K}_{2/3}\text{CoO}_2$  cell in the voltage range of 2.0 – 3.9 V at a current density of  $11.5 \text{ mA g}^{-1}$ .



**Fig. S4** Operando X-ray diffraction patterns of a Na // P2- $\text{Na}_{2/3}\text{CoO}_2$  cell with 1 mol  $\text{dm}^{-3}$   $\text{NaPF}_6/\text{PC}$  in the voltage range of 2.0 - 4.45 V. Diffraction peaks of all the patterns can be indexed as a P2-type phase with space group of  $P6_3/mmc$ .