

Supporting information

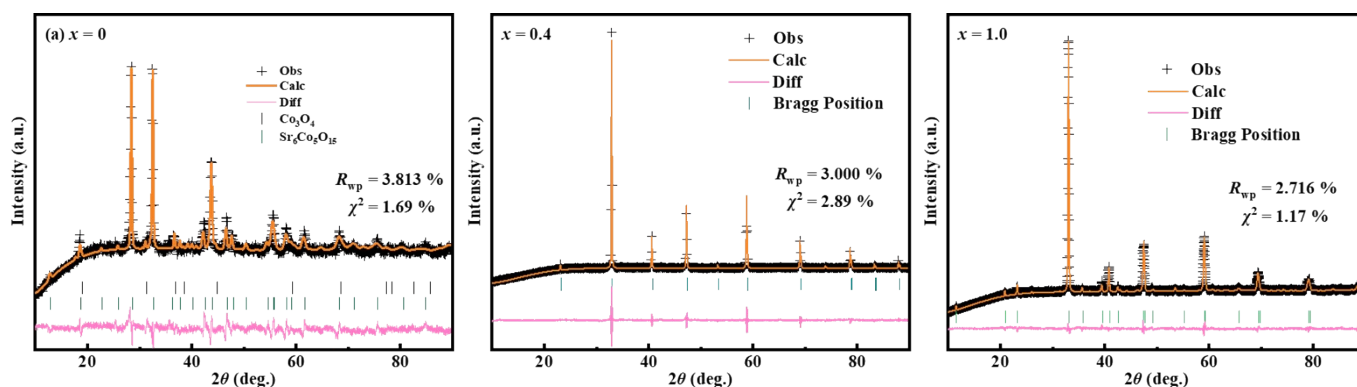


Figure 1. Rietveld refinement analysis of XRD patterns. (a) $x=0$, (b) $x=0.4$, (c) $x=1.0$

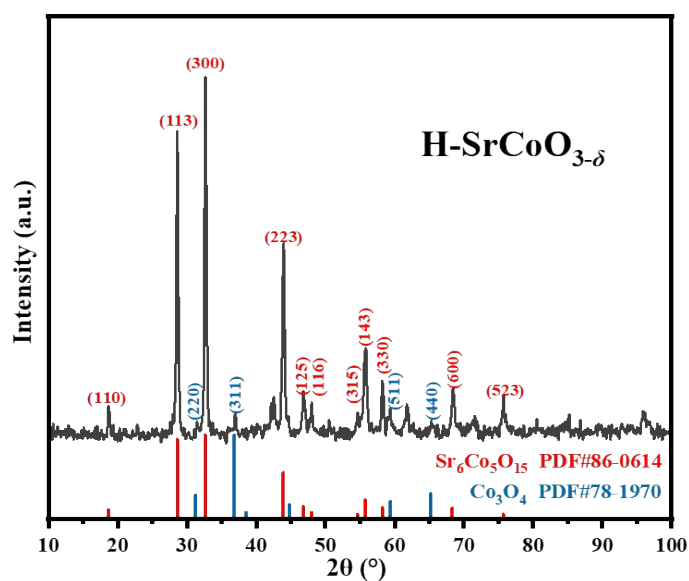


Figure 2. XRD patterns of $H-SrCoO_{3-\delta}$. Red: $Sr_6Co_5O_{15}$, blue: Co_3O_4

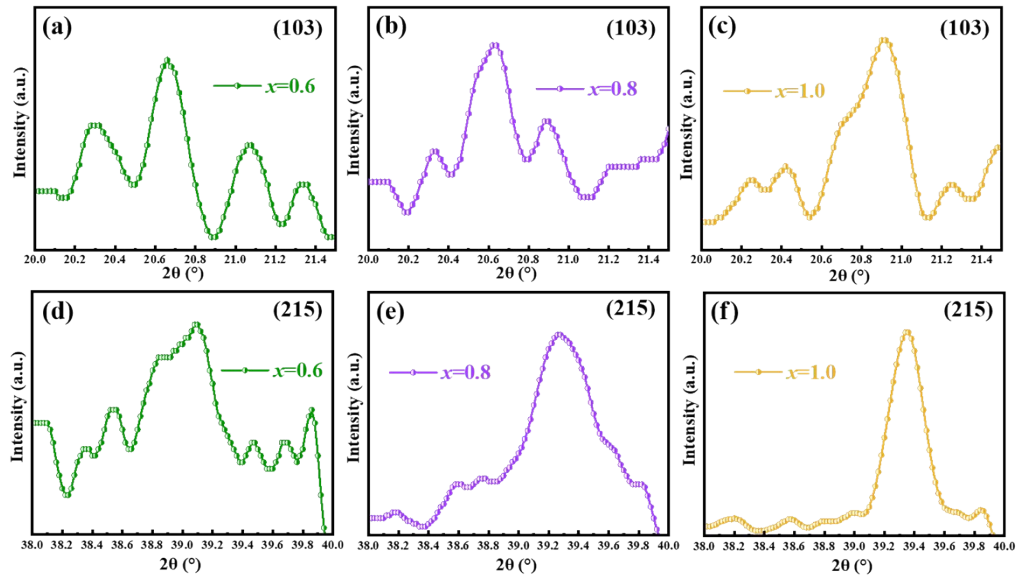


Figure 3. Slow scan XRD patterns of $\text{Sr}_{4-x}\text{Y}_x\text{Co}_4\text{O}_{12-\delta}$ ($x=0.6\sim 1.0$) polycrystals (103) and (215).

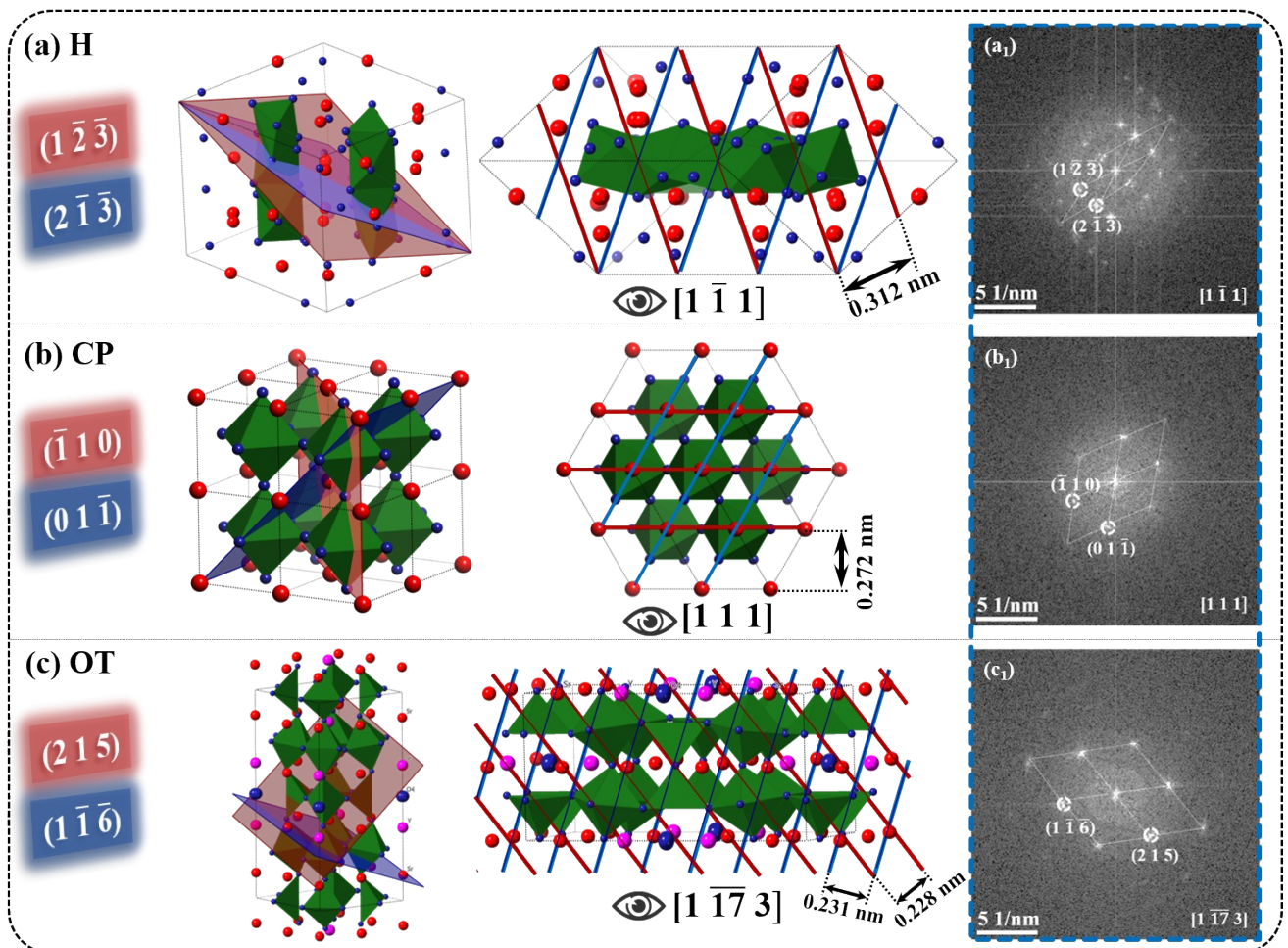


Figure 4. Position relations of TEM diffraction crystal planes in the crystal structure of $\text{Sr}_{4-x}\text{Y}_x\text{Co}_4\text{O}_{12-\delta}$ ($x=0, 0.4, 1.0$) ceramics. (a) $x=0$, (b) $x=0.4$, (c) $x=1.0$.

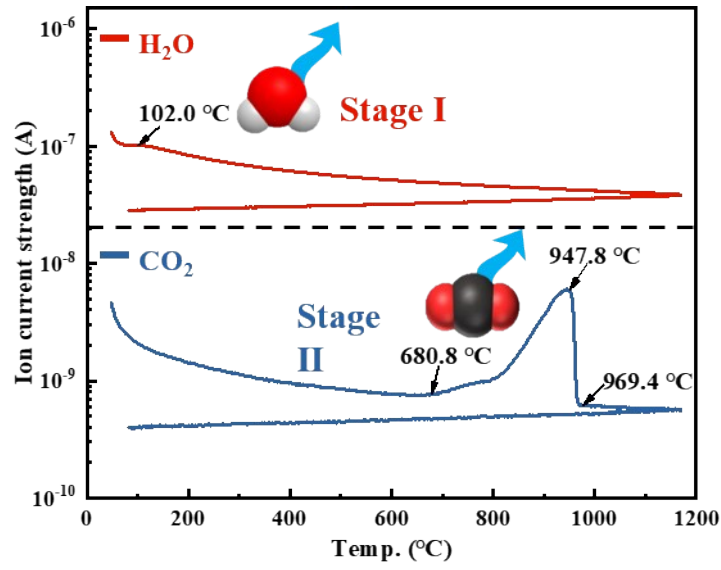


Figure 5. MS diagram of the sample $\text{SrCoO}_{3-\delta}$ ($x=0$) during the heating process.

Table. 1. Iodine titration results for $\text{Sr}_3\text{YCo}_4\text{O}_{10.5+\delta}$. A: 1000 °C, B: 1180 °C. \bar{a} : Oxygen content

Process numbers	Sintering processes	Titre value 1	Titre value 2	Titre value 3	\bar{a}
A	1000°C/24 h	10.504	10.500	10.494	10.499
B	1180°C/24 h	10.560	10.557	10.554	10.557

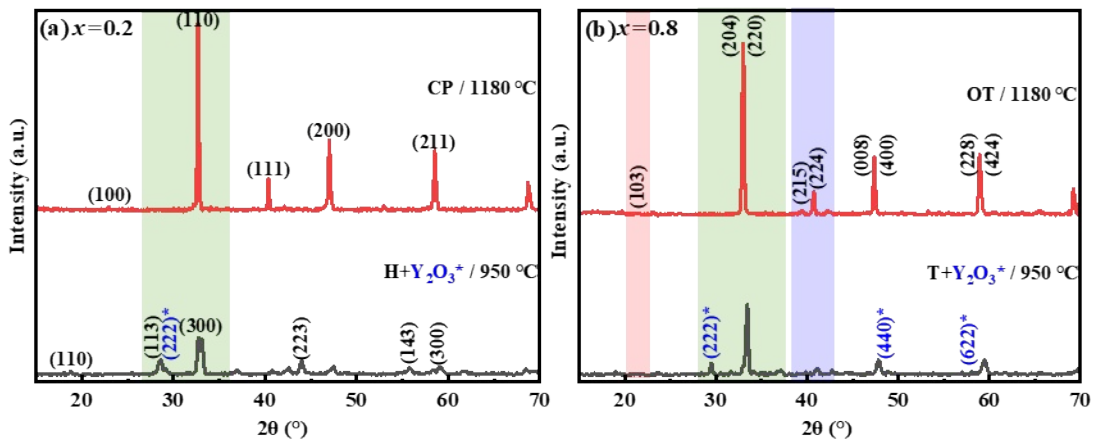


Figure 6. XRD patterns of $\text{Sr}_{4-x}\text{Y}_x\text{Co}_4\text{O}_{12-\delta}$ ($x=0.2, 0.8$) ceramics sintering at 950 °C and 1180 °C. (a) $x=0.2$, (b) $x=0.8$.