

Effect of Trivalent Dopants on Phase Stability and Catalytic Activity of YBaCo₄O₇-based Cathodes in Solid Oxide Fuel Cells

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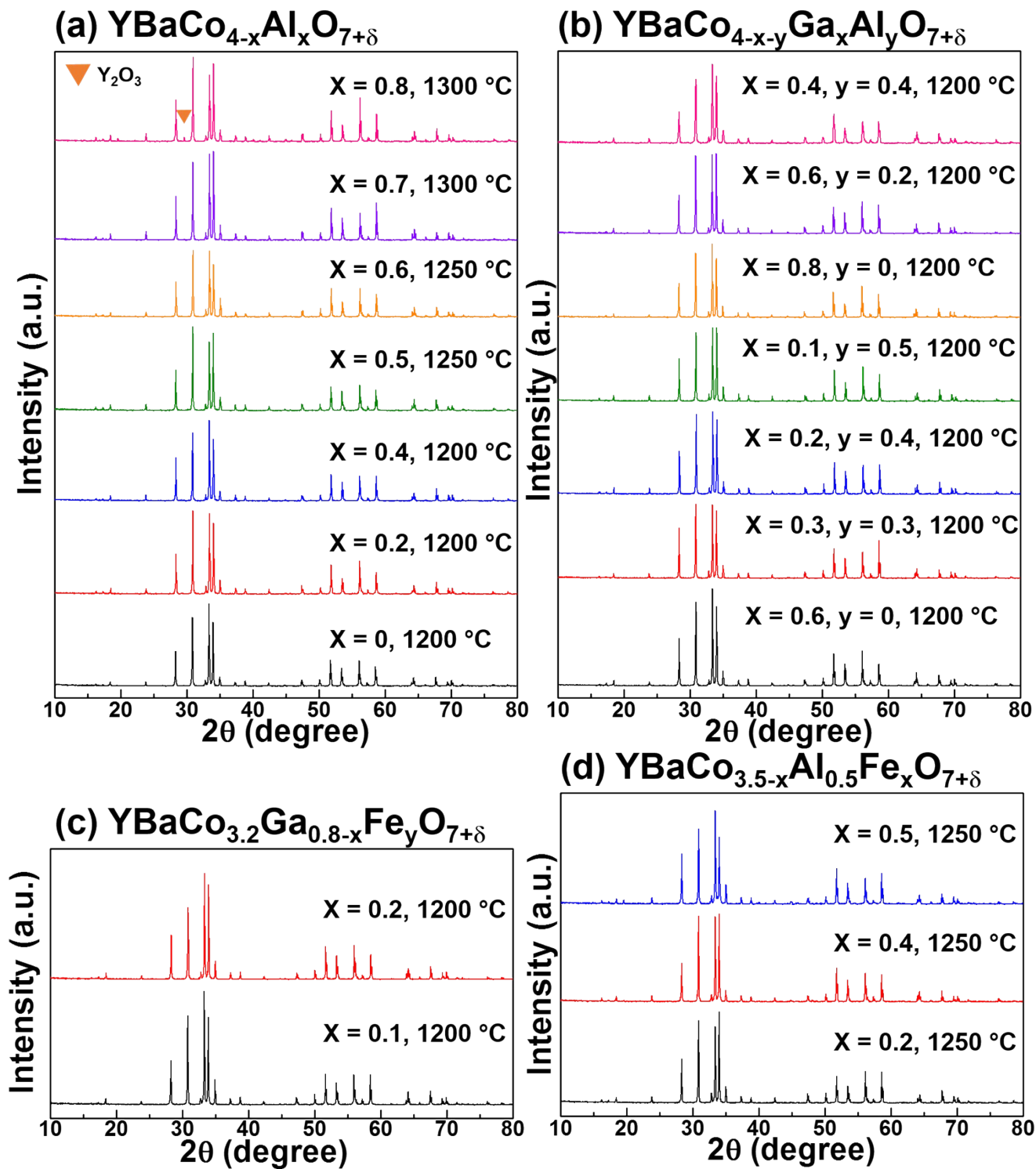


Fig. S1. XRD patterns of as-synthesized (a) $\text{YBaCo}_{4-x}\text{Al}_x\text{O}_{7+\delta}$, (b) $\text{YBaCo}_{4-x-y}\text{Ga}_x\text{Al}_y\text{O}_{7+\delta}$, (c) $\text{YBaCo}_{4-x-y}\text{Ga}_x\text{Al}_y\text{O}_{7+\delta}$, and (d) $\text{YBaCo}_{3.5}\text{Al}_{0.5}\text{Fe}_x\text{O}_{7+\delta}$. The sintering temperature is 1,200 °C for $\text{YBaCo}_{4-x-y}\text{Ga}_x\text{Al}_y\text{O}_{7+\delta}$ and $\text{YBaCo}_{4-x-y}\text{Ga}_x\text{Al}_y\text{O}_{7+\delta}$. When the Al content in $\text{YBaCo}_{4-x}\text{Al}_x\text{O}_{7+\delta}$ and $\text{YBaCo}_{3.5}\text{Al}_{0.5}\text{Fe}_x\text{O}_{7+\delta}$ exceeds 0.5 in the formula, the final sintering temperature is over 1200 °C.

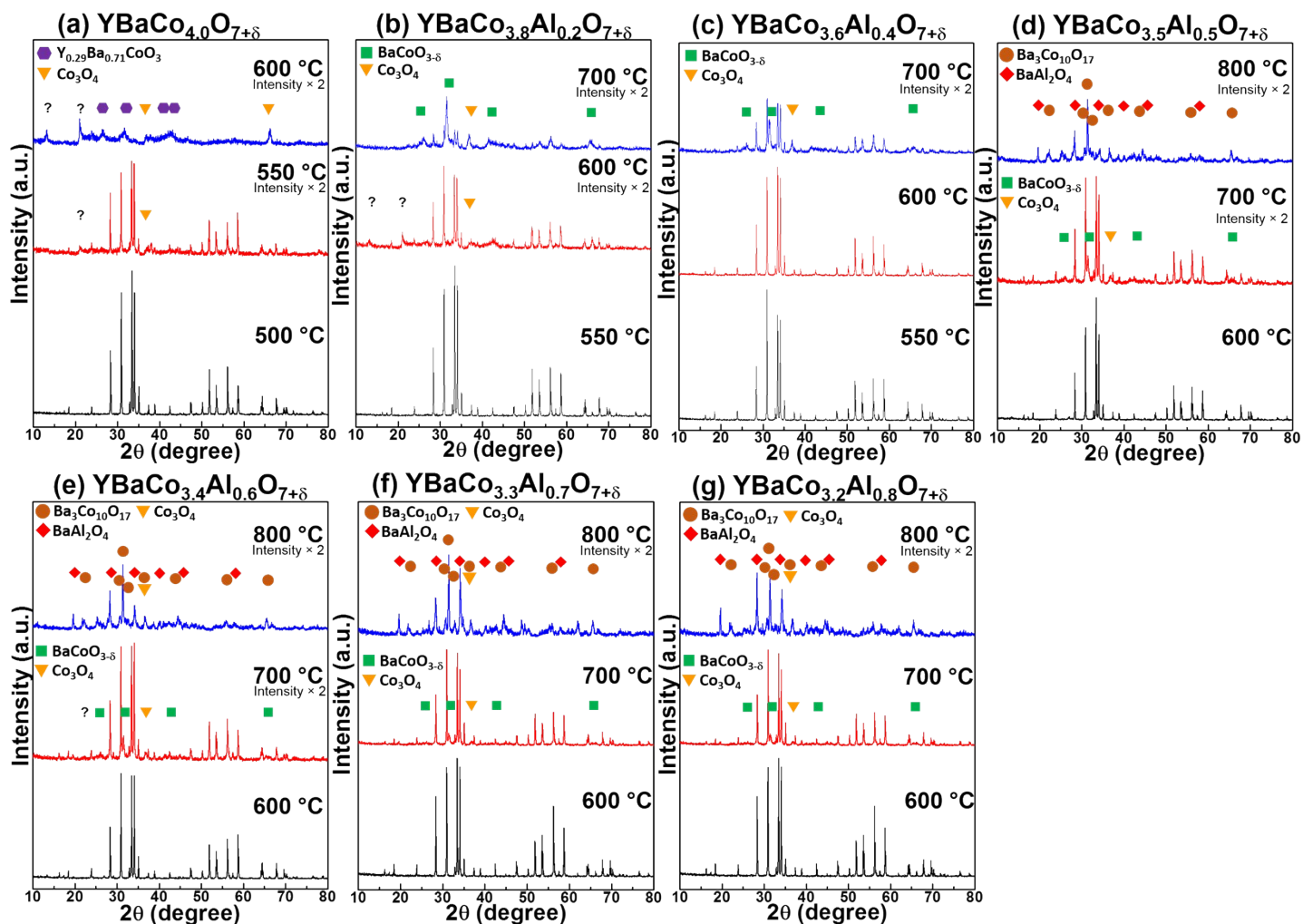


Fig. S2. RT-XRD patterns of the (a) $\text{YBaCo}_4\text{O}_{7+\delta}$, (b) $\text{YBaCo}_{3.8}\text{Al}_{0.2}\text{O}_{7+\delta}$, (c) $\text{YBaCo}_{3.6}\text{Al}_{0.4}\text{O}_{7+\delta}$, (d) $\text{YBaCo}_{3.5}\text{Al}_{0.5}\text{O}_{7+\delta}$, (e) $\text{YBaCo}_{3.4}\text{Al}_{0.6}\text{O}_{7+\delta}$, (f) $\text{YBaCo}_{3.3}\text{Al}_{0.7}\text{O}_{7+\delta}$, and (g) $\text{YBaCo}_{3.2}\text{Al}_{0.8}\text{O}_{7+\delta}$ samples annealed at various temperatures for 120 h. The intensities of the decomposed samples decrease significantly, so the intensity of some XRD pattern is doubled for clarity, which is noted in the figure. Impurity peaks of an unknown phase is marked as “?”.

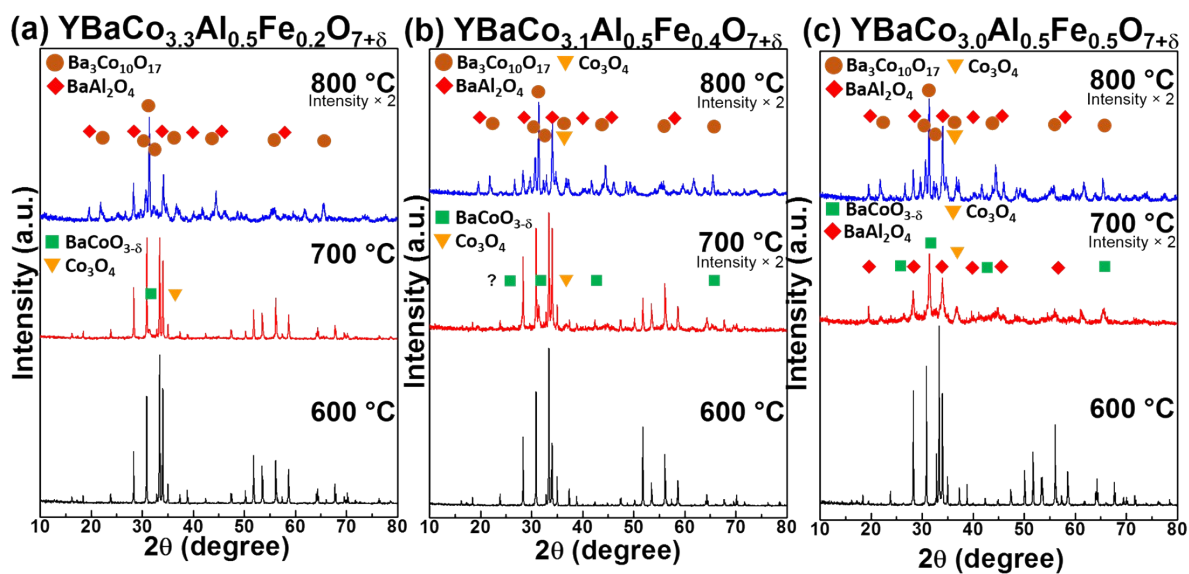


Fig. S3. RT-XRD patterns of the (a) $\text{YBaCo}_{3.3}\text{Al}_{0.5}\text{Fe}_{0.2}\text{O}_{7+\delta}$, (b) $\text{YBaCo}_{3.1}\text{Al}_{0.5}\text{Fe}_{0.4}\text{O}_{7+\delta}$, and (c) $\text{YBaCo}_{3.0}\text{Al}_{0.5}\text{Fe}_{0.5}\text{O}_{7+\delta}$ samples annealed at 600 - 800 °C for 120 h. The intensities of the decomposed samples decrease significantly, so the intensity of some XRD pattern is doubled for clarity, which is noted in the figure.