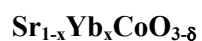


## Supplementary information

### **Structural evolution, electrochemical kinetic properties, and stability of A-site doped perovskite**



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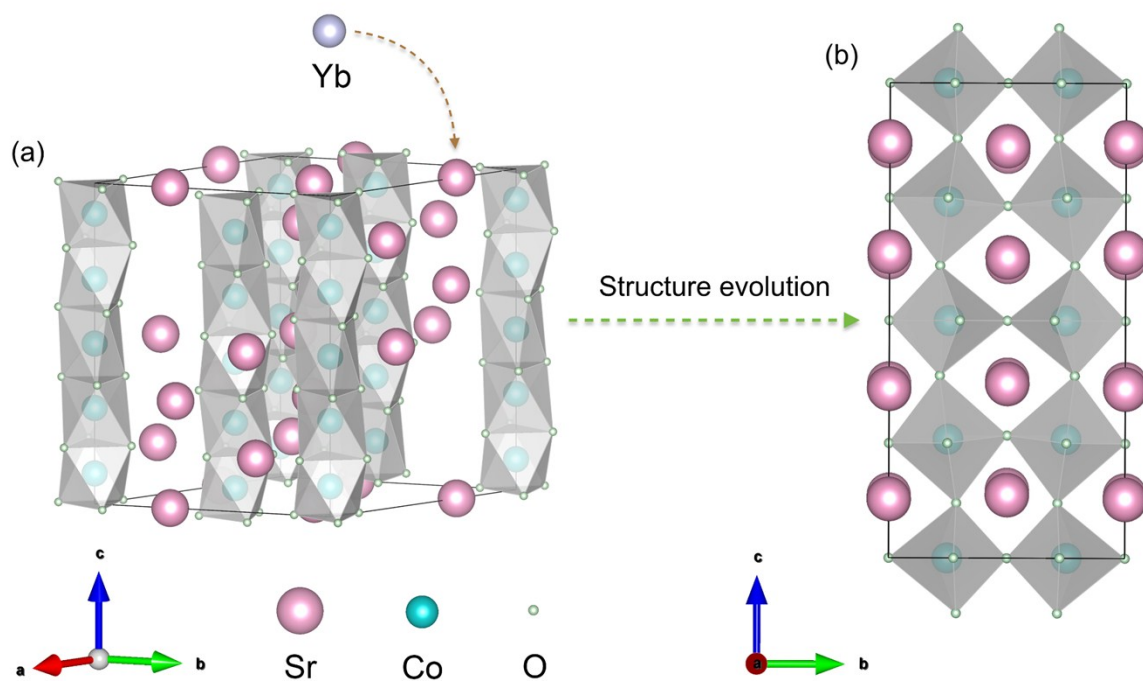


Fig. S1 Schematic of crystal structures: (a) SYbC0 at room temperature ( $\text{Sr}_6\text{Co}_5\text{O}_{15}$ , space group  $R32^1$ ), (b) SYbC10 at room temperature (space group  $I4/mmm^2$ ). The crystal structures are visualized with VESTA program.<sup>3</sup>

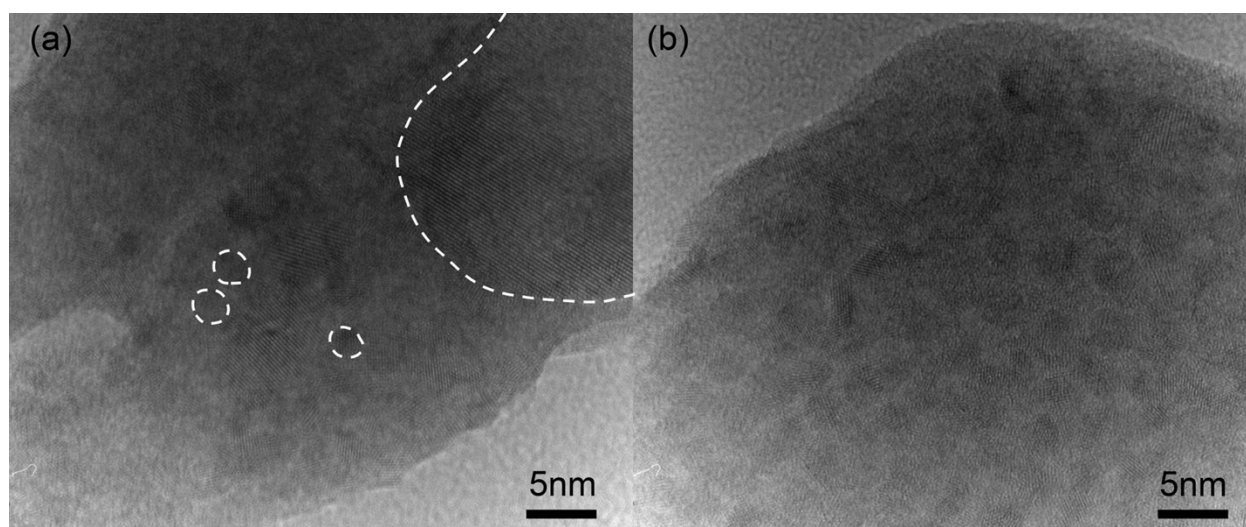


Fig. S2 TEM images of SYbC10 powder: (a) particles with different sizes are marked, (b) aggregation of small particles.

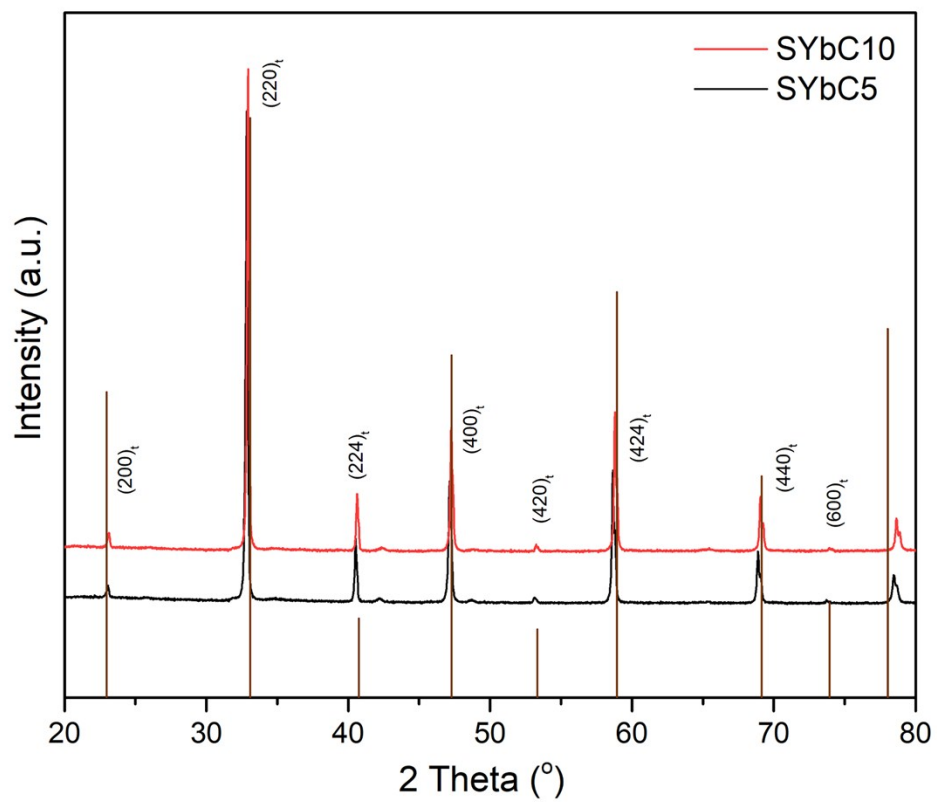


Fig. S3 XRD patterns of SYbC5 and SYbC10 powders calcinated at 1000 °C in air for 6 h, indices of tetragonal symmetry.

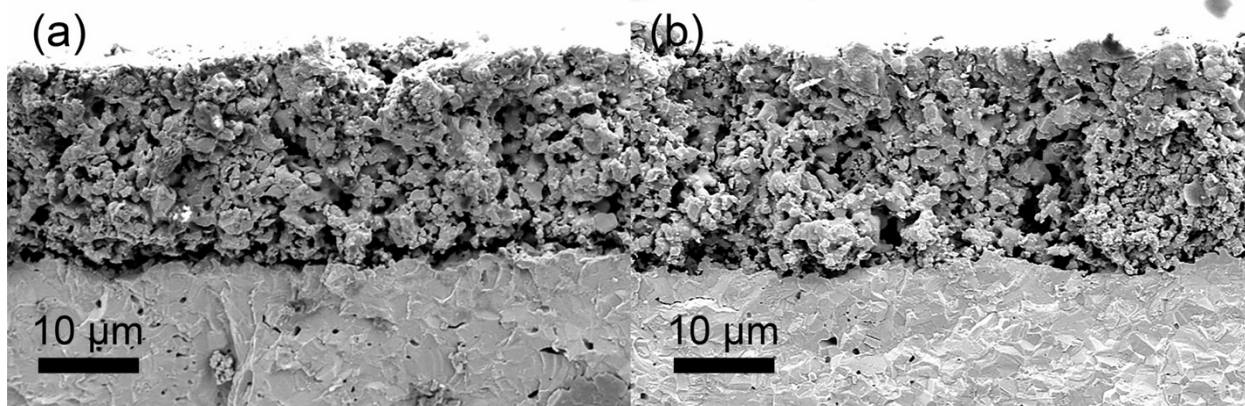


Fig. S4 Cross-sectional SEM micrographs of symmetrical cell with SYbc5 (a) and SYbc10 (b) electrode sintered at 1050 °C in air for 2 h.

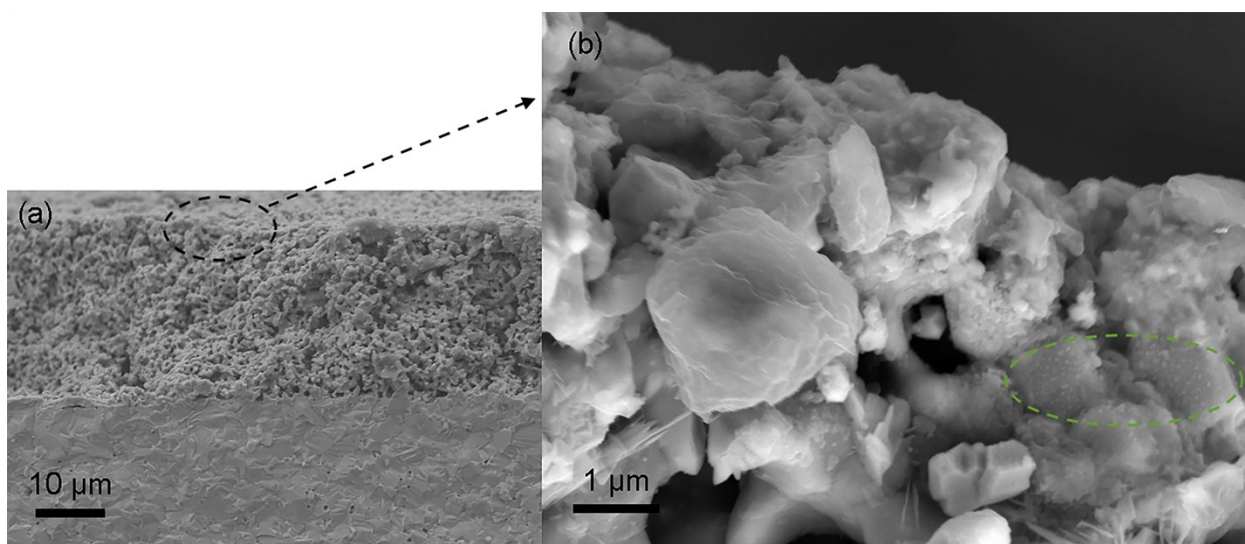


Fig. S5 Cross-sectional SEM micrographs of symmetrical cell with SYbc10 electrode after durability test (a) and locally enlarged SEM image (b), the area with surface exsolved nano-particles are marked.

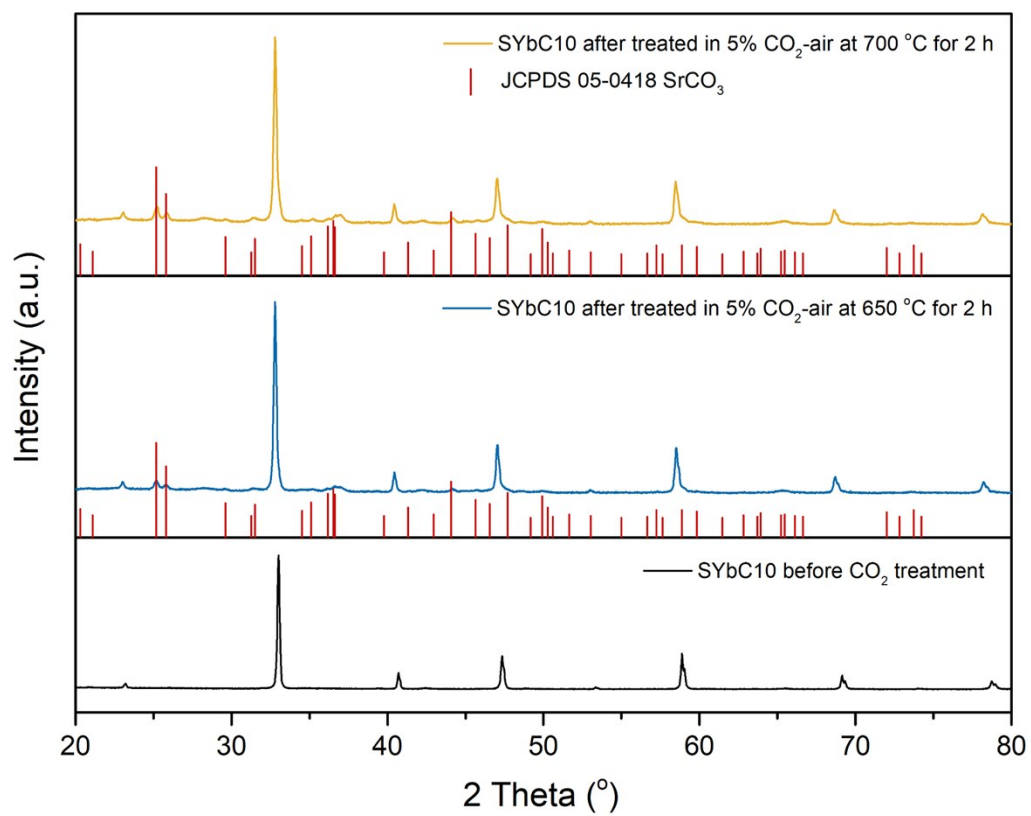


Fig. S6 XRD patterns of SYbC10 powders before and after treated at 700 and 650 °C respectively in 5% CO<sub>2</sub>-air for 2 h followed by cooling down under the protection of nitrogen gas, and peak position of SrCO<sub>3</sub> (JCPDS 05-0418).

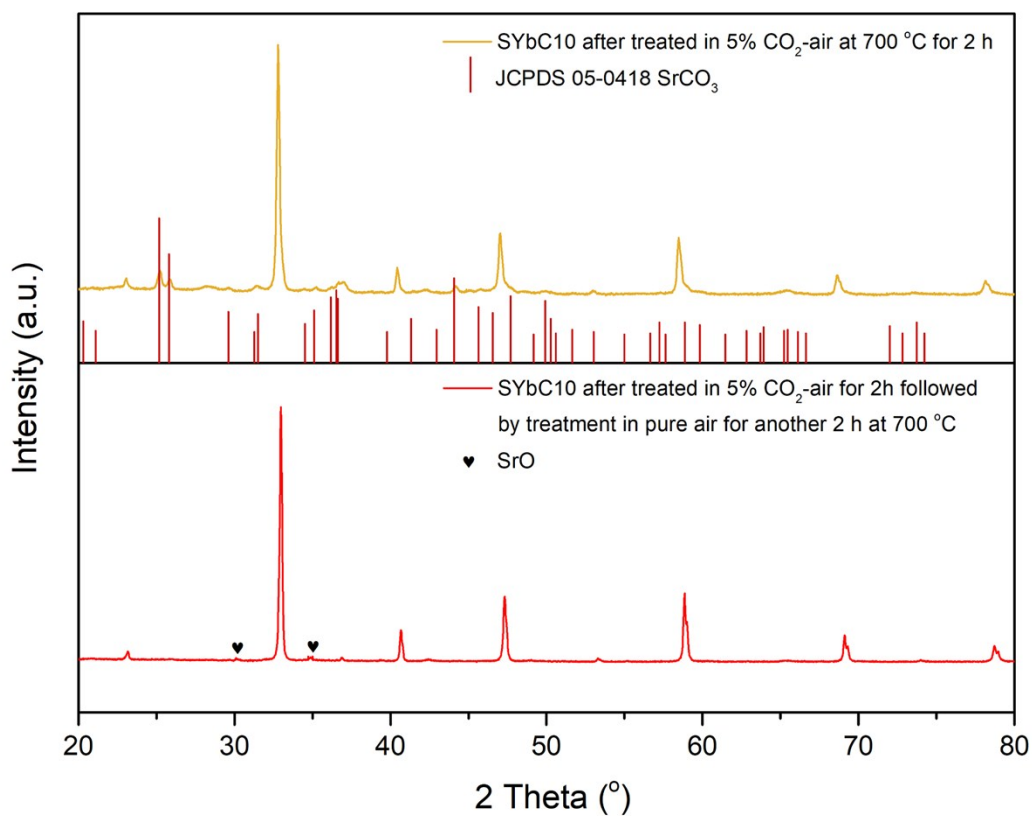


Fig. S7 XRD patterns of SYbC10 powders after treated at 700 in 5%  $\text{CO}_2$ -air for 2 h followed by cooling down under the protection of nitrogen gas, and those after treated at 700 in 5%  $\text{CO}_2$ -air for 2 h followed by treatment in pure air for another 2 h at 700 °C.

## References

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2. C. Sarno, T. Yang, E. Di Bartolomeo, A. Huq, K. Huang and S. McIntosh, *Solid State Ionics*, 2018, **321**, 34-42.
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