Supporting Information

Ca$_2$Co$_2$O$_5$ as thermoelectric SOFC cathode material

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**Figure S1.** XRD of CCO obtained after calcination in air and oxygen at 800 °C.

**Figure S2.** The Co2p core level XPS spectra of CCO2.
**Figure S3.** Conductivity data of CCO1 and CCO2 measured in air from 300 to 850 °C.

**Figure S4.** Power density dependent on operation time at 750 °C for CCO2 conventional fuel cell.
**Figure S5.** Cell voltage and power density as functions of current density for improved thermoelectric SOFCs structure with dense CCO2 column as cathode.

**Figure S6.** Impedance spectra of the symmetrical half cell using CCO2 as electrodes measured in air at 700, 750, and 800 °C.
Figure S7. SEM images for the fuel cell with CCO2 as cathode after testing at 800 °C. a) Cross section of the cell configuration. b) The surface of the CCO2 cathode. c) Section between CCO2 cathode and LSGM electrolyte. d) Energy-dispersive X-ray (EDX) analysis of the CCO2 cathode surface (the ratio of Ca with Co about 1:1).