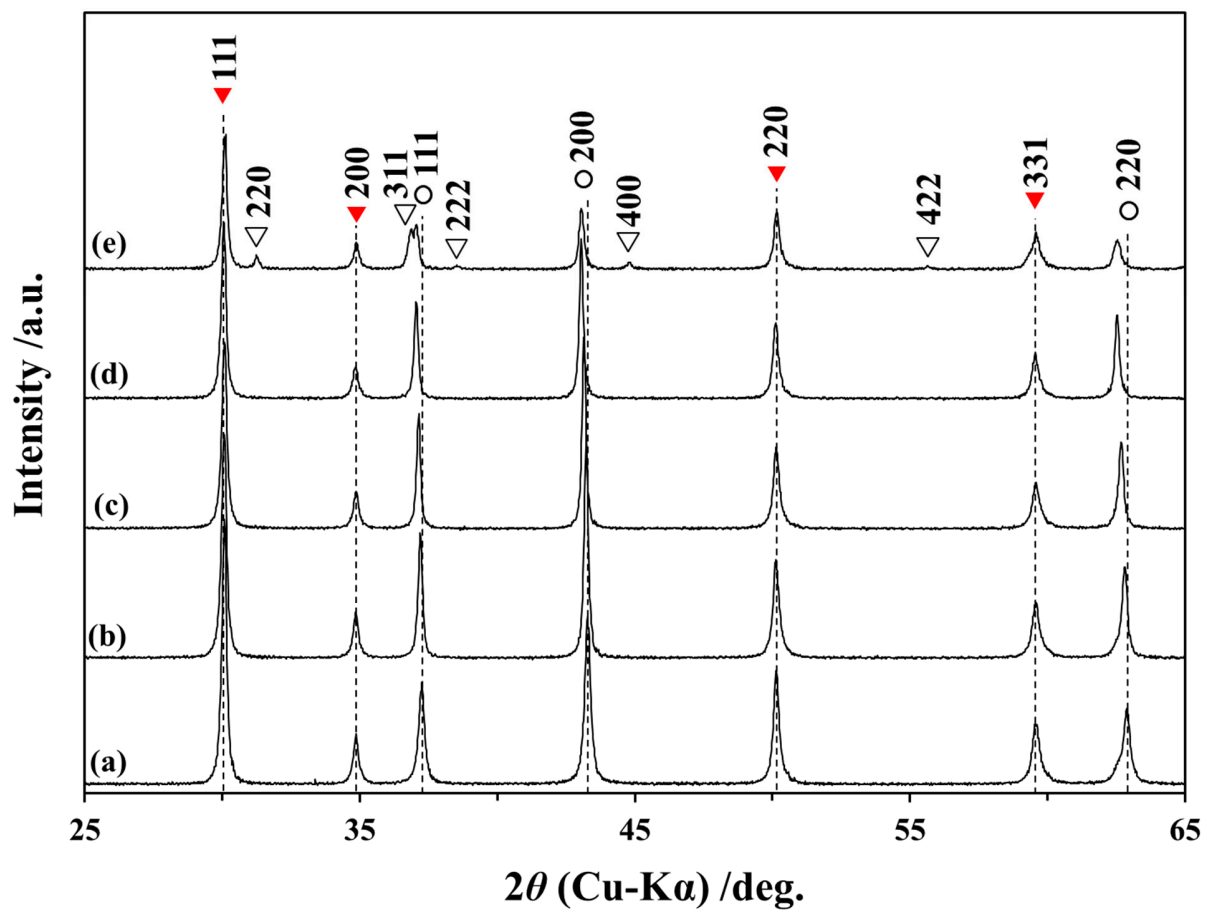


*Figure S1.* XRD patterns of the  $\text{Ni}_{1-x}\text{Co}_x\text{O}$ -YSZ powders prepared by sintering at 1300 °C for 3 h in air ( $\circ$ :  $\text{Ni}_{1-x}\text{Co}_x\text{O}$ ,  $\blacktriangledown$ : YSZ). (a)  $x = 0$ , (b)  $x = 0.05$ , (c)  $x = 0.15$ , (d)  $x = 0.25$  and (e)  $x = 0.50$ .



**Figure S2.** XRD patterns of the Ni<sub>1-x</sub>Co<sub>x</sub>O-YSZ powders prepared by calcination at 800 °C for 5 h in air (○: Ni<sub>1-x</sub>Co<sub>x</sub>O, ▼: YSZ, ▽: Co<sub>3</sub>O<sub>4</sub>). (a) x = 0, (b) x = 0.05, (c) x = 0.15, (d) x = 0.25 and (e) x = 0.50.

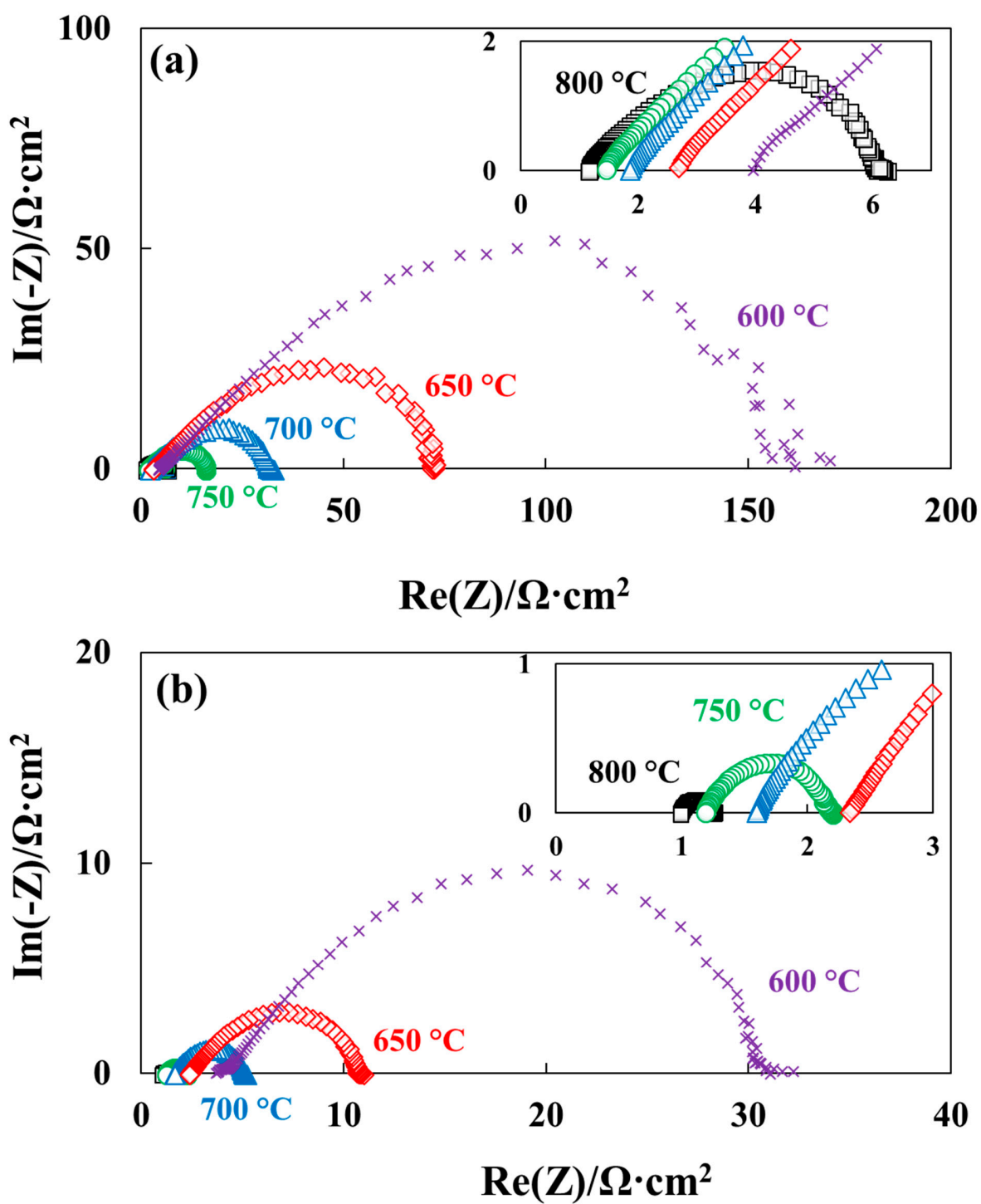


Figure S3. Impedance spectra of symmetric cell measured at 600-800 °C under  $\text{H}_2$  atmosphere of (a) Ni-YSZ|YSZ|Ni-YSZ and (b)  $\text{Ni}_{0.75}\text{Co}_{0.25}$ -YSZ|YSZ| $\text{Ni}_{0.75}\text{Co}_{0.25}$ -YSZ

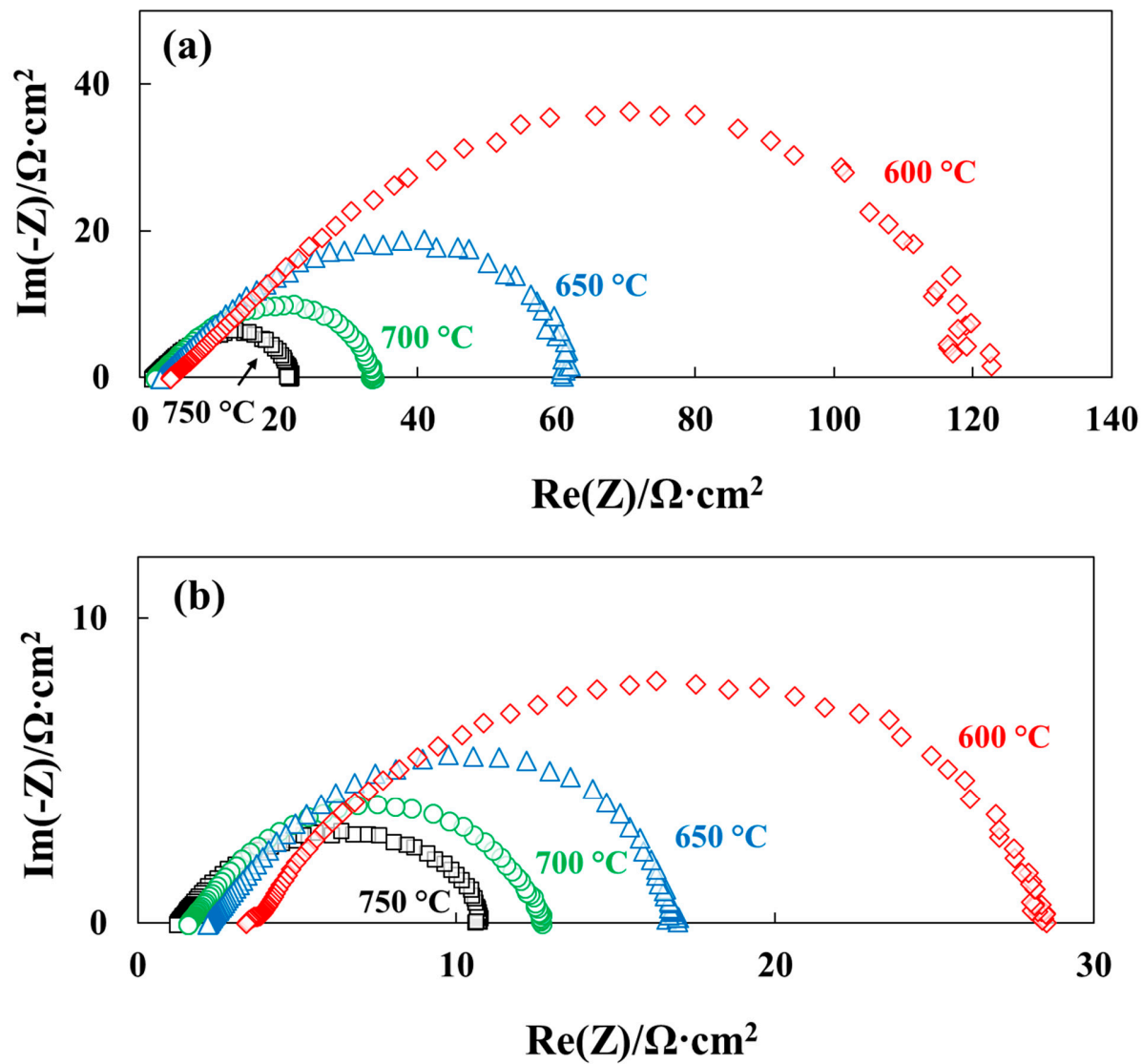


Figure S4. Impedance spectra of symmetric cell measured at 600-800 °C under CH<sub>4</sub> atmosphere of (a) Ni-YSZ|YSZ|Ni-YSZ and (b) Ni<sub>0.75</sub>Co<sub>0.25</sub>-YSZ|YSZ|Ni<sub>0.75</sub>Co<sub>0.25</sub>-YSZ