Integrated design of a Ni thin-film electrode on a porous alumina template for affordable and high-performance low-temperature solid oxide fuel cells

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Fig. S1. Current-voltage ($I$-$V$) characteristics of a full cell with a 100 nm-thick Ni ASE measured at 500°C.

Fig. S2. Estimated power density of a full cell with a 100 nm-thick Ni ASE based on the ASR values of only the anode. Linear $I$-$V$ characteristics are assumed.
**Fig. S3.** Top-view SEM images of well-defined, 20 μm (a) Ni and (b) Pt patterns on a YSZ substrate. (c) The impedance spectra of both symmetric cells (Ni|YSZ|Ni and Pt|YSZ|Pt) measured at 600°C with anodic ($p_{H_2} = 0.1$ atm, $p_{H_2O} = (8.2 \pm 0.6) \times 10^{-3}$ atm) and cathodic ($p_{O_2} = 0.21$ atm) conditions.

**Table S1.** The electrolyte-area normalized electrode resistances and capacitances of both symmetric cells (Ni|YSZ|Ni and Pt|YSZ|Pt) measured at 600°C with anodic ($p_{H_2} = 0.1$ atm, $p_{H_2O} = (8.2 \pm 0.6) \times 10^{-3}$ atm) and cathodic ($p_{O_2} = 0.21$ atm) conditions.

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<tr>
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<th>600°C</th>
<th>Ni-YSZ</th>
<th>Pt-YSZ</th>
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<tbody>
<tr>
<td>ASR (Ωcm²)</td>
<td></td>
<td>902</td>
<td>6537</td>
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<tr>
<td>Capacitance (Fcm⁻²)</td>
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<td>$4 \times 10^{-5}$</td>
<td>$3 \times 10^{-4}$</td>
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