$SmBaCo_2O_{5+\delta}$ double perovskite with epitaxially grown $Sm_{0.2}Ce_{0.8}O_{2-\delta}$ nanoparticles as the promising cathode for solid oxide fuel cells

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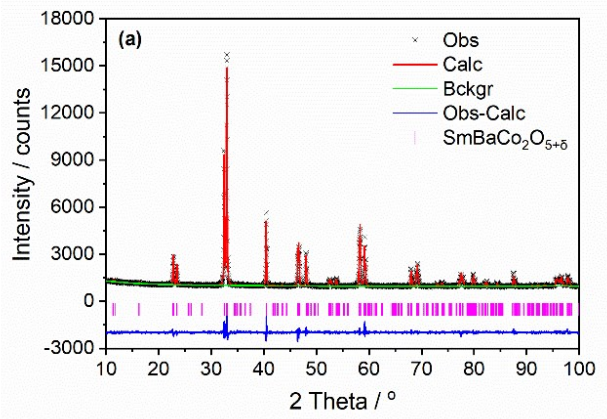
Supporting information



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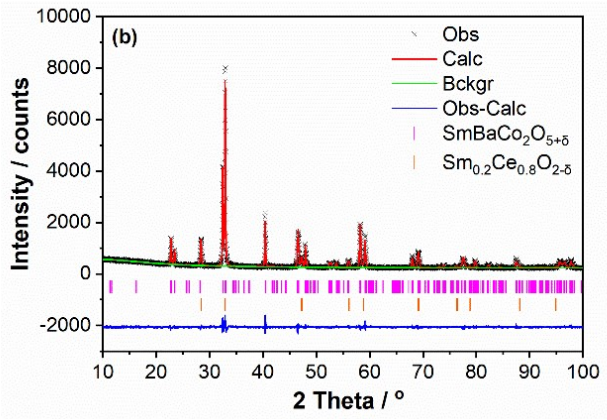

Figure S1. Rietveld refinement of room temperature XRD patterns of SBCO and SBCO-SDC

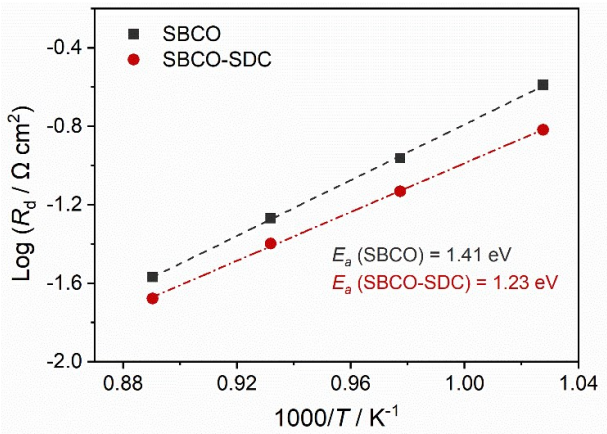

Figure S2. Polarization resistance (R_d) versus reciprocal temperature for SBCO-SDC and SBCO electrodes in air.

Tab. S1. Comparison of peak power density for LSGM electrolyte-supported cells between $SmBaCo_2O_{5+\delta}$-SDC NPs and selected double perovskite cathodes.

Cathode	anode	Electrolyte thickness / μm	Temperature / °C	Power density / mW cm^{-2}	reference
$NdBa_{0.5}Sr_{0.5}Co_2O_{5+\delta}$	Ni–GDC	300	850	904	[1]
$Pr_{1.1}Ba_{0.9}Co_2O_{5+\delta}$	Ni-SDC	300	800	732	[2]
$PrBa_{0.5}Sr_{0.5}Co_2O_{5+\delta}$	Ni-GDC	300	800	1021	[3]
$PrBaC_2O_{5+\delta}$-SDC				758	
$NdBaC_2O_{5+\delta}$-SDC	Ni-SDC	300	800	707	[4]
$SmBaC_2O_{5+\delta}$-SDC				685	

$GdBaC_2O_{5+\delta}$-SDC				608	
$YBaCo_{1.4}Cu_{0.6}O_{5+\delta}$	Ni–GDC	300	850	815	[5]
$YBa_{0.5}Sr_{0.5}Co_{1.4}Cu_{0.6}O_{5+\delta}$	Ni–GDC	300	850	398	[6]
$SmBa_{0.5}Sr_{0.5}CoCuO_{5+\delta}$	NiCu–GDC	300	850	857	[7]
$NdBaCoFeO_{5+\delta}$-30SDC	Ni-SDC	300	800	892	[8]
$PrBa_{0.8}Ca_{0.2}Co_2O_{5+\delta}$	$PrBaMn_2O_{5+\delta}$	250	700	460	[9]
$GdBa_{0.4}Sr_{0.6}Co_2O_{5+\delta}$	Ni-GDC	500	800	490	[10]
$NdBaCo_{2/3}Fe_{2/3}Cu_{2/3}O_{5+\delta}$	Ni-GDC	300	800	719	[11]
$PrBa_{0.5}Sr_{0.5}Co_{1.5}Fe_{0.5}O_{5+\delta}$	Ni-SDC	300	850	697	[12]
$SmBaCo_2O_{5+\delta}$-SDC NPs	Ni-GDC	300	850	977	This work
			800	806	
			750	592	
			700	408	
			650	230	

References:

[1] Lü S. et al. *J. Power Sources*, 2010, **195**, 8094-8096.

[2] Jiang L. et al. *Electrochim. Acta*, 2014, **133**, 364–372.

[3] Lü S., Long G., Meng X, et al. *Int. J. Hydrogen Energy*, 2012, **37**, 5914-5919.

[4] Zhou Q. et al. *J. Power Sources*, 2010, **195**, 2174-2181.

[5] Zhang Y., Yu B., Lü S., et al. *Electrochim. Acta*, 2014, **134**, 107-115.

[6] Lü S. et al. *Ceram. Int.*, 2014, **40**, 14919-14925.

[7] Wang B., Long G., Li Y., et al. *Int. J. Hydrogen Energy*, 2016, **41**, 13603-13610.

[8] Jin F., Liu J., Shen Y., et al. *J. Alloys Compd.*, 2016, **685**, 483-491.

[9] Lim C., Jun A., Jo H., et al. *J. Mater. Chem. A*, 2016, **4**, 6479-6486.

[10] Kim, J. H., Prado, F., Manthiram, A. *J. Electrochem. Soc.*, 2008, **155(10)**, B1023-B1028.

[11] Jin F., Li L., He, T. *J. Power Sources,* 2015, **273**, 591-599.

[12] Jiang L.,Wei T., Zeng R., et al. *J. Power Sources,* 2013, **232**, 279-285.