Supplementary Information

Hydrogen Tungsten Bronze as a Decoking Agent for Long-Life, Natural Gas-Fueled Solid Oxide Fuel Cells

Daeil Yoon and Arumugam Manthiram*
Materials Science and Engineering Program
The University of Texas at Austin
Austin, Texas 78712, USA.

Corresponding author: (E-mail) manth@austin.utexas.edu

Supplementary Figures

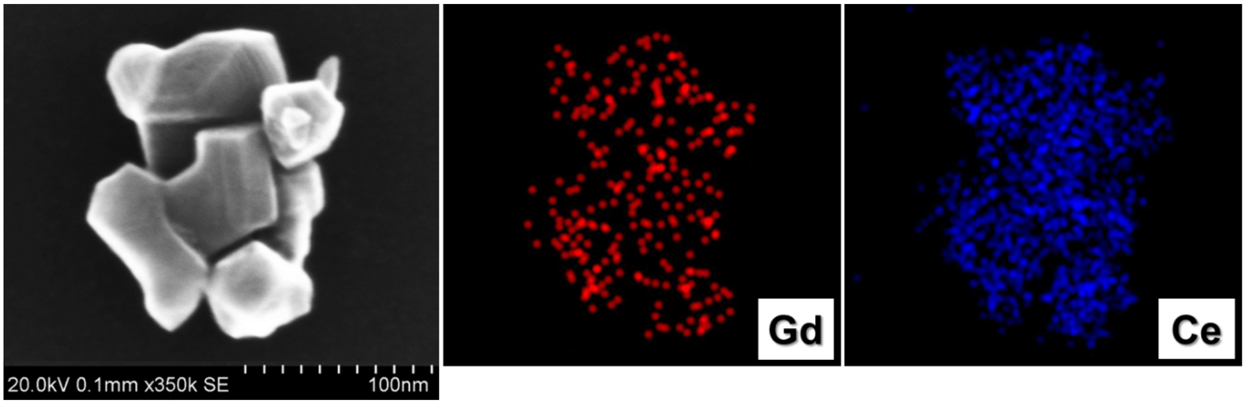

Fig. S1 STEM/EDS micrographs of GDC powder. 50 – 100 nm sized GDC powder synthesized by a glycine-nitrate combustion process is utilized for fabricating the thin-film electrolyte layer of anode-supported single cell SOFCs by co-pressing/co-firing technique.

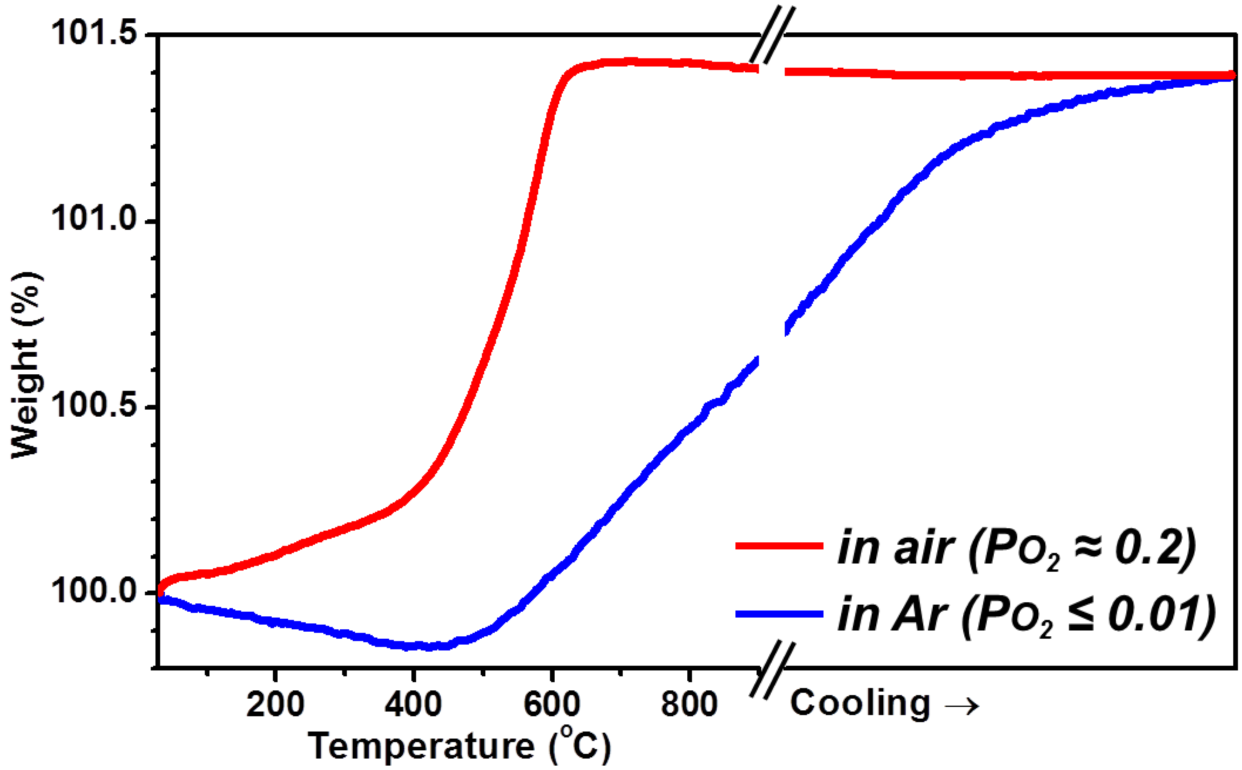

Fig. S2 Thermogravimetric analysis (TGA) of $H_xWO_{3-\delta}$ (Fig. 1c and 1e in the manuscript). As for the TGA in Ar (extremely low oxygen partial pressure), the hydroxyl groups in $H_xWO_{3-\delta}$ are removed at temperatures below 450 °C, and then the $H_xWO_{3-\delta}$ is oxidized by the small amount of oxygen present in the Ar supply. In air, $H_xWO_{3-\delta}$ is oxidized by oxygen with a removal of the hydroxyl groups at temperatures below 450 °C; at temperatures above 450 °C, it is rapidly oxidized because of a lack of hydroxyl groups.

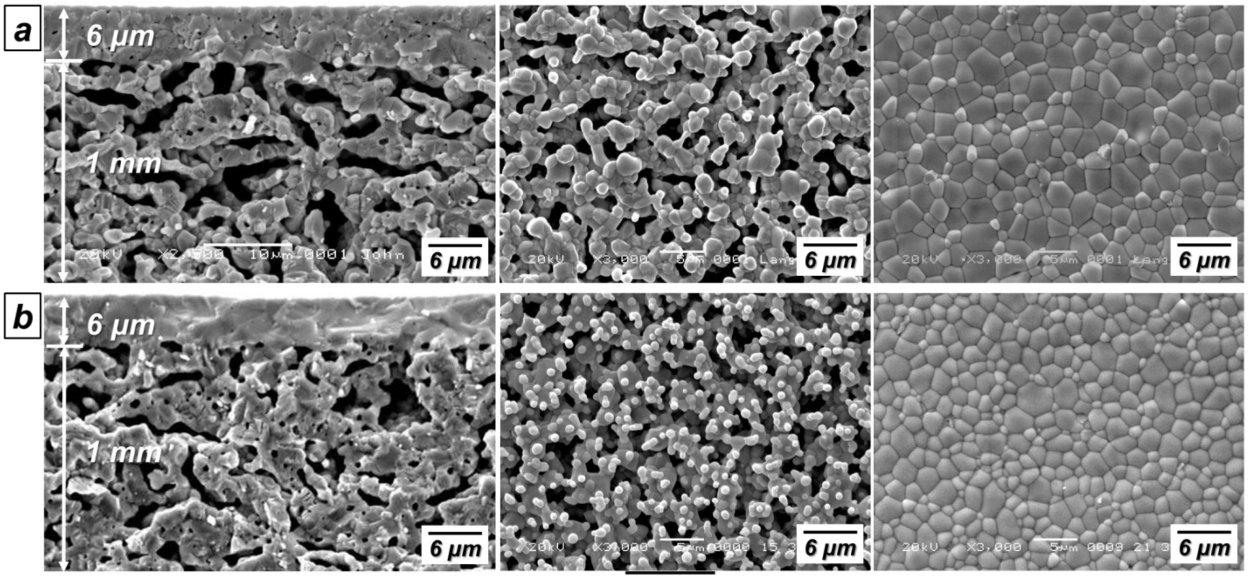

Fig. S3 Cross-section and anode and electrolyte surface micrographs of NiO-GDC (a) and modified NiO-GDC (b) anode-supported electrolytes made by co-pressing/co-firing technique. The thicknesses of the thin-film electrolyte layer and anode substrate are, respectively, ~ 6 µm and ~ 1 mm. As compared to the NiO-GDC anode, the enlargement of the three-phase boundary regions of modified NiO-GDC anode leads to the enhanced performance of single cell SOFCs.