In-situ Oxygen Isotopic Exchange Vibrational Spectroscopy of Rhenium Oxide Surface Structures on Cerium Oxide

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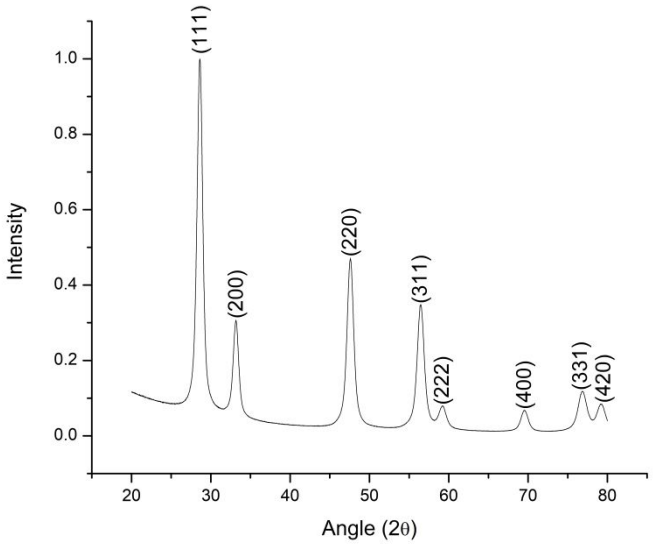

Figure1S. XRD pattern of 1 wt.% ReO_x/CeO_2 at a scanning rate of 0.5°min.

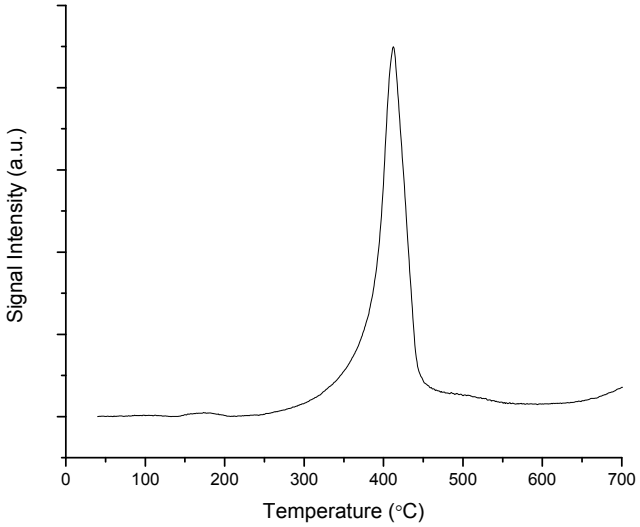

Figure 2S. H_2 TPR spectrum of 1 wt.% ReO_x/CeO_2.

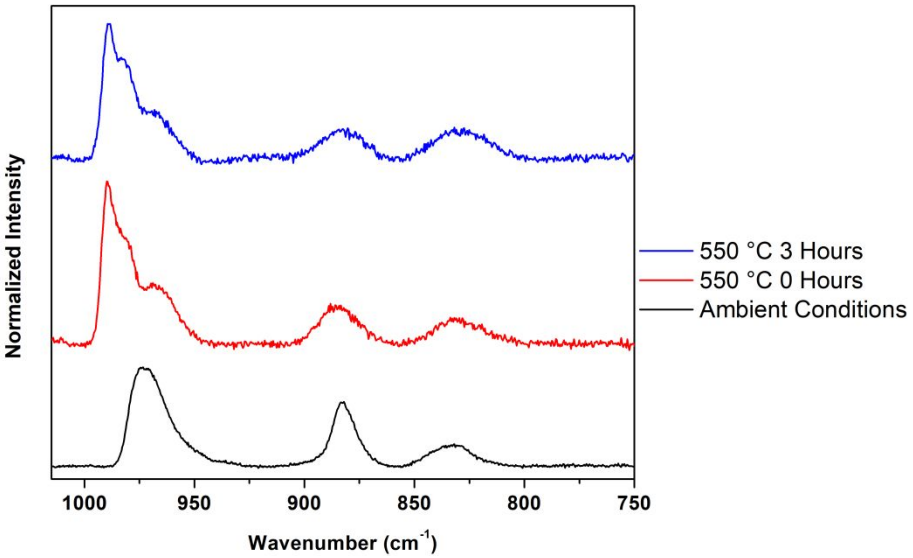

Figure 3S. Raman spectra showing the signal-to-noise comparison between the sample heated at 550 °C for 0 hours and after 3 hours.

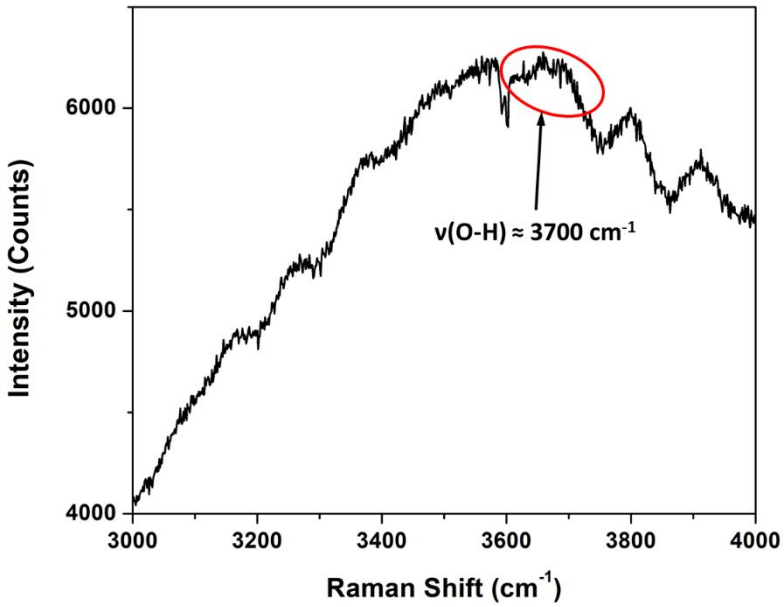

Figure 4S. Raman spectrum of 1 wt.% ReOx/CeO2 highlighting the O-H stretch.

Table 1S. Raman band area for the observed vibration modes.

Raman Spectra Area		
	$^{18}O/^{16}O$ Ratio	
Vibrational Mode	**^{18}O First Cycle**	**^{18}O Second Cycle**
ν (Re=O)	**1.68**	**9.86**
ν_s (O=Re=O)	**1.37**	**2.45**
ν_{as} (O=Re=O)	**1.37**	**2.45**
ν_{as} (Re-O-Re)	**1.09**	**Near Complete**
δ(Re-OH)	**1.36**	**Near Complete**

Table 2S. FTIR spectra band area for the visible modes in the spectra after 25 minutes of ^{18}O exposure.

FTIR Spectra Area		
	$^{18}O/^{16}O$ Ratio	
Vibrational Mode	**^{18}O First Cycle**	**^{18}O Second Cycle**
ν (Re=O)	**0.243**	**1.467**
ν_s (O=Re=O)	**0.350**	**1.873**
ν_{as} (O=Re=O)	**0.350**	**1.873**
ν_{as} (Re-O-Re)	**0.148**	**1.298**

Table 3S. Ration between the integrated intensities of the symmetric and asymmetric di-oxo stretches in the Raman and FTIR.

Integrated Intensity			
	ν_s (O=Re=O)	**ν_{as} (O=Re=O)**	**Sym/Asym Ratio**
Raman	**122.38**	**85.64**	**1.43**
Raman (Isotope)	**123.55**	**86.46**	**1.43**
FTIR	**0.374**	**0.377**	**0.99**
FTIR (Isotope)	**0.662**	**0.669**	**0.99**