Supplementary Information

Superior Low-temperature NO Catalytic Performance of PrMn$_2$O$_5$ Over SmMn$_2$O$_5$ Mullite-type Catalysts

Sampreetha Thampy, a Nickolas Ashburn, a Chengfa Liu, b Ka Xiong, b Sean Dillon, a Yongping Zheng, a Yves J Chabal, a Kyeongjae Cho, a and Julia W. P. Hsu* a

a Department of Materials Science & Engineering, University of Texas at Dallas, Richardson, Texas 75080, United States
b Dongguan Innovative New Materials Co. Ltd, Room 206, Building No.5, Incubation Park for Sci&Tech SMEs, Songshan Lake, Dongguan, Guangdong China 523808
* Corresponding author: Department of Materials Science and Engineering, University of Texas at Dallas, Richardson, Texas 75080, United States; Phone: +1 (972) 883-5789
E-mail: jwhsu@utdallas.edu

NO conversion efficiencies of PrMn$_2$O$_5$ and SmMn$_2$O$_5$ samples synthesized under similar hydrothermal conditions of 180 °C for 24 h and processed with different concentrations of HNO$_3$ (0-8%) are measured to optimize the processing condition to facilitate maximum conversion of NO. The NO conversion efficiency as a function of reaction temperature for samples treated with 0% (black triangles), 2% (red circles), and 8% (blue squares) HNO$_3$ are shown in Fig. S1. The activity of PrMn$_2$O$_5$ (Fig. S1a) improved only slightly from no acid wash (Fig. S1a, black triangles) to 2% HNO$_3$ wash (Fig. S1a, red circles), while washing with 8% HNO$_3$ (Fig. S1a, blue squares) shows the best performance. On the other hand, the best conversion efficiency for SmMn$_2$O$_5$ (Fig. S1b) is obtained with washing with 2% HNO$_3$ (Fig. S1b, red circles) while further increase in acid concentration to 8% (Fig. S1b, blue squares) decreased the catalytic activity. Therefore, we determine 8% and 2% acid wash to be the optimal processing condition.
for PrMn$_2$O$_5$ and SmMn$_2$O$_5$, respectively. Hence, these two processing conditions were used for this study.

![Graph](image)

**Fig. S1.** NO conversion efficiency as a function of temperature for (a) PrMn$_2$O$_5$; (b) SmMn$_2$O$_5$ with no acid wash (black triangles), 2% HNO$_3$ wash (red circles), and 8% HNO$_3$ wash (blue squares), respectively. The reaction gas composition consisted of 400 ppm NO, 10% O$_2$, and N$_2$ balance at a space velocity of 100000 h$^{-1}$. 
Fig. S2. XPS spectra of O 1s core-levels in (a) PrMn$_2$O$_5$ (blue); (b) SmMn$_2$O$_5$ (red) samples, respectively. The green and black lines represent the peak fitting on PrMn$_2$O$_5$ and SmMn$_2$O$_5$, respectively.

Fig. S3. FTIR spectra after coadoption of 1% NO and 10% O$_2$ balanced with He at 40 °C on (a) PrMn$_2$O$_5$ (blue) and (b) SmMn$_2$O$_5$ (red), respectively.
Fig. S4. N 1s XPS spectra shows nitrate at 407.3 eV as the dominant intermediate species formed after exposure to NO at 40 °C on (a) PrMn$_2$O$_5$ (blue) and (b) SmMn$_2$O$_5$ (red), respectively.