Electronic supplementary information

NO Catalytic Oxidation over Ultra-large Surface Area $LaMnO_{3+\delta}$ Perovskite Synthesized by Acid-etching Method

Baohuai Zhao,[a] Rui Ran,[a,*] Li Sun,[a] Xingguo Guo,[a] Xiaodong Wu[b] and Duan Weng[a,b,*]

[a] *State Key Laboratory of New Ceramic and Fine Processing, School of Materials Science and Engineering, Tsinghua University, Beijing 100084, China*

[b] *Key Laboratory of Advanced Materials (MOE), School of Materials Science and Engineering, Tsinghua University, Beijing 100084, China*

In-situ diffuse reflectance infrared Fourier-transform spectroscopy (DRIFTS) was performed at a resolution of 4 cm^{-1} in the range of 400 - 4000 cm^{-1}, using a Nicolet iS50 spectrometer equipped with a mercury cadmium telluride detector. The catalysts were pretreated in the DRIFTS cell at 300 °C in 10% O_2/N_2 for 30 min to clean the surface of the catalyst and then cooled down to 30 °C. Then the background spectrum was recorded in N_2 at each selected temperature. After background spectrum subtraction, the catalysts were exposed to reactant gas mixture containing 500 ppm NO, 10% O_2, balanced with N_2 for 30 min to reach a steady state. The spectra were recorded with time. Then the temperature was ramped up to 300 °C and the spectra were recorded at intervals of 50 °C. The total flow rate was maintained at 100 mL min^{-1}.

Fig. S1 shows the adsorption spectra as functions of time at 30 °C and along with temperature ramping in the range 800 - 2000 cm^{-1}. The spectrum contains bands at 1625, 1590, 1547, 1496, 1283, 1226, and 1028 cm^{-1}. The bands at 1625, 1590, 1547, 1496 and 1283 cm^{-1} are assigned to nitrate species [1-14], those at 1028 and 1226 cm^{-1}

are attributed to nitrite species [3, 5, 6, 9, 14].

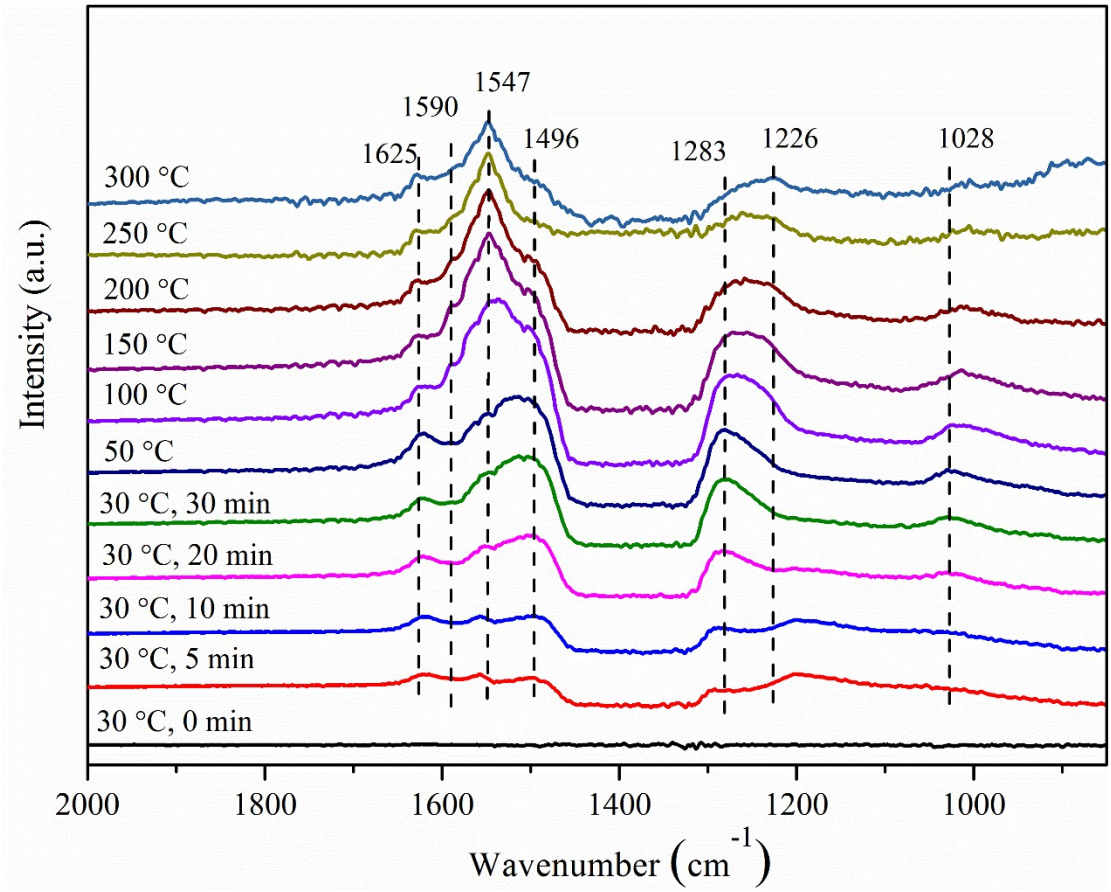

Fig. S1 Evolution of *in-situ* DRIFTS of LMO-12. Reaction conditions: 500 ppm NO, 10% O_2, and N_2 balance; total flow rate 100 mL min^{-1}; temperature rate 10 ºC min^{-1}.

Notes and references

1. W. Wang, G. McCool, N. Kapur, G. Yuan, B. Shan, M. Nguyen, U. M. Graham, B. H. Davis, G. Jacobs and K. Cho, *Sci.*, 2012, **337**, 832-835.
2. N. Tang, Y. Liu, H. Wang and Z. Wu, *J. Phy. Chem. C*, 2011, **115**, 8214-8220.
3. W. S. Kijlstra, D. S. Brands, E. K. Poels and A. Bliek, *J. Catal.*, 1997, **171**, 208-218.
4. Z. Wu, N. Tang, L. Xiao, Y. Liu and H. Wang, *J. Colloid Inter. Sci.*, 2010, **352**, 143-148.
5. G. Qi and R. T. Yang, *J. Phy. Chem. B*, 2004, **108**, 15738-15747.
6. M. Richter, A. Trunschke, U. Bentrup, K.-W. Brzezinka, E. Schreier, M. Schneider, M.-M. Pohl and R. Fricke, *J. Catal.*, 2002, **206**, 98-113.
7. G. Qi, W. Li, Catal. Today, 2015, **258**, 205-213.
8. Z. Liu, Y. Yi, J. Li, S. I. Woo, B. Wang, X. Cao and Z. Li, *Chem. Commun.*, 2013, **49**, 7726-7728.

9. X. Wu, S. Liu, F. Lin and D. Weng, *J. Hazard Mater.*, 2010, **181**, 722-728.
10. L. Guo, H. Xian, Q.-F. Li, D. Chen, Y.-S. Tan, J. Zhang, L.-R. Zheng and X.-G. Li, *J. Hazard Mater.*, 2013, **260**, 543-551.
11. M. Machida, D. Kurogi and T. Kijima, *Chem. Mater.*, 2000, **12**, 3165-3170.
12. E. Lim, Y. J. Kim, J. H. Kim, T. Ryu, S. Lee, B. K. Cho, I.-S. Nam, J. W. Choung and S. Yoo, *J. Catal.*, 2014, **319**, 182-193.
13. Z. Lian, F. Liu, H. He, X. Shi, J. Mo and Z. Wu, *Chem. Eng. J.*, 2014, **250**, 390-398.
14. K. Hadjiivanov, V. Avreyska, D. Klissurski and T. Marinova, *Langmuir*, 2002, **18**, 1619-1625.