Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

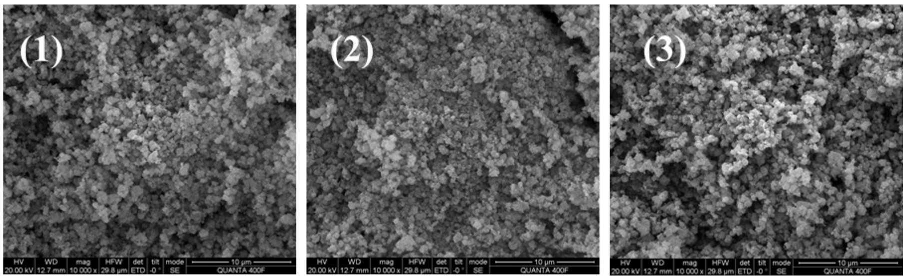
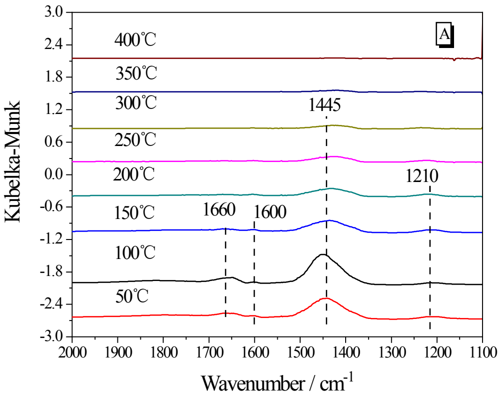
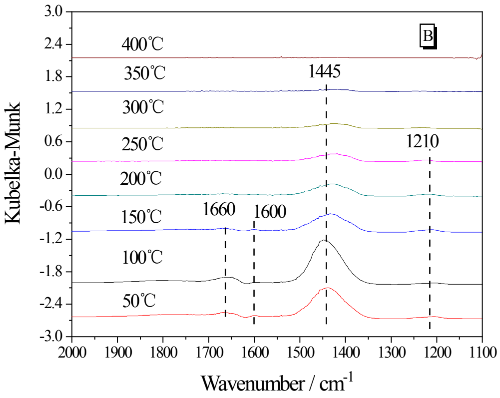
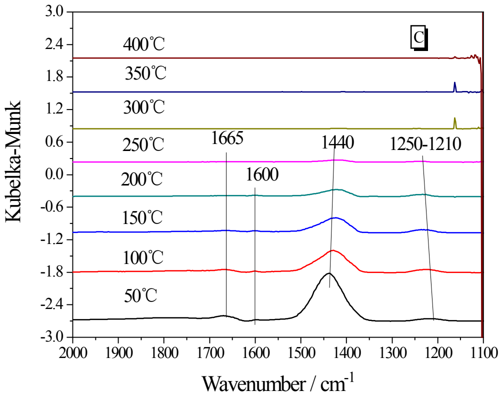


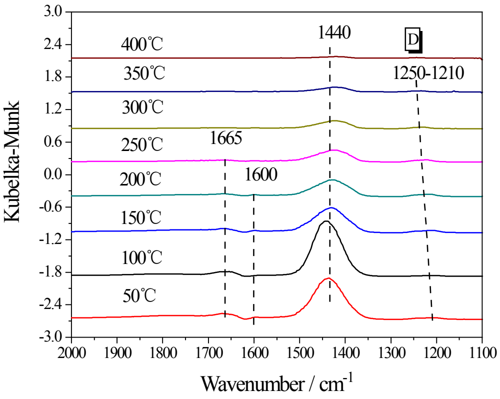
Figure S1 SEM of $V_{2.5}W_5Mo_xSb_y/TiO_2$ catalysts

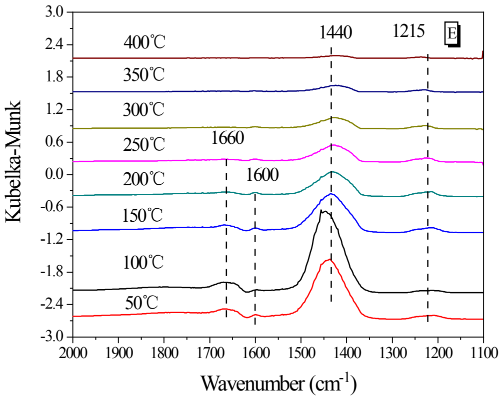
(1) $V_{0.04}W_{0.03}/TiO_2$; (2) $V_{0.04}W_{0.03}Mo_{0.015}/TiO_2$; (3) $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.018}/TiO_2$

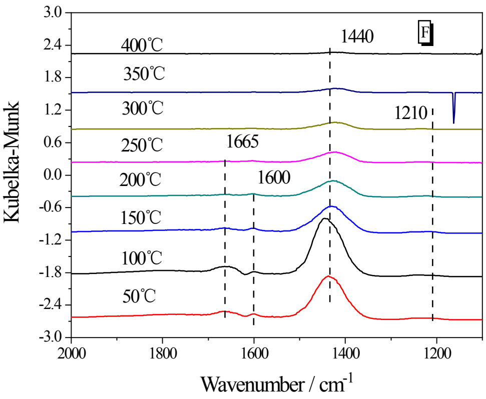












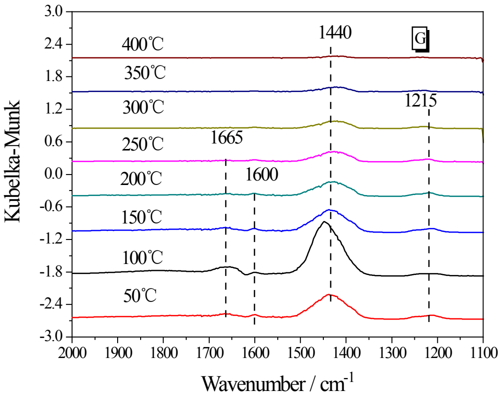


Figure S2 In situ DRIFTS spectra of $V_{0.04}W_{0.03}Mo_xSb_y/TiO_2$ treated in 500 ppm NH_3 at room temperature for 1 h and then purged by N_2 at different temperatures: (a) $V_{0.04}W_{0.03}/TiO_2$; (b) $V_{0.04}W_{0.03}Sb_{0.018}/TiO_2$; (c) $V_{0.04}W_{0.03}Mo_{0.015}/TiO_2$; (d) $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.012}/TiO_2$; (e) $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.018}/TiO_2$; (f) $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.024}/TiO_2$ and (g) $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.030}/TiO_2$

Fig.S2 showed the in-situ DRIFTS results of $V_{0.04}W_{0.03}Mo_xSb_y/Ti$ catalyst adsorbed with NH_3 at 25 °C, then flushed with N_2 at different temperatures. Several bands were found at 1660, 1600, 1440 and 1218 cm^{-1}. Bands at 1600 cm^{-1} and 1218 cm^{-1} can be attributed to the symmetric and asymmetric deformation vibration of NH_3 adsorbed on Lewis acid sites [1, 2]. Bands at 1660 cm^{-1} and 1440 cm^{-1} were assigned to the symmetric and asymmetric deformation of NH_4^+ bound to Brönsted acid sites [3, 4], indicating the catalytic surface was mainly covered by the NH_3 adsorbed on Brönsted acid sites. It could be found that the intensities of all adsorption bands decreased with increasing the temperature. As observed in Fig. S1(b), the intensity of the band at 1440 cm^{-1} was significantly enhanced as the Mo adding, which meant more Brönsted acid sites was formed on the surface of the catalysts. Fig. S1(c) showed the NH_3 adsorption results of the Sb-modified catalyst. The improvement effect of Sb was manifested in the increased adsorption strength and stability of NH_3, which was consistent with the performance test results. In addition, Fig S2(d-g) described the modified results of Sb loading on the basis of molybdenum modification. The results revealed that the Brönsted acid sites (bands at 1660 and 1440 cm^{-1}) were further enhanced by the modification of Sb, which remained at 250 °C and 400 °C, respectively.

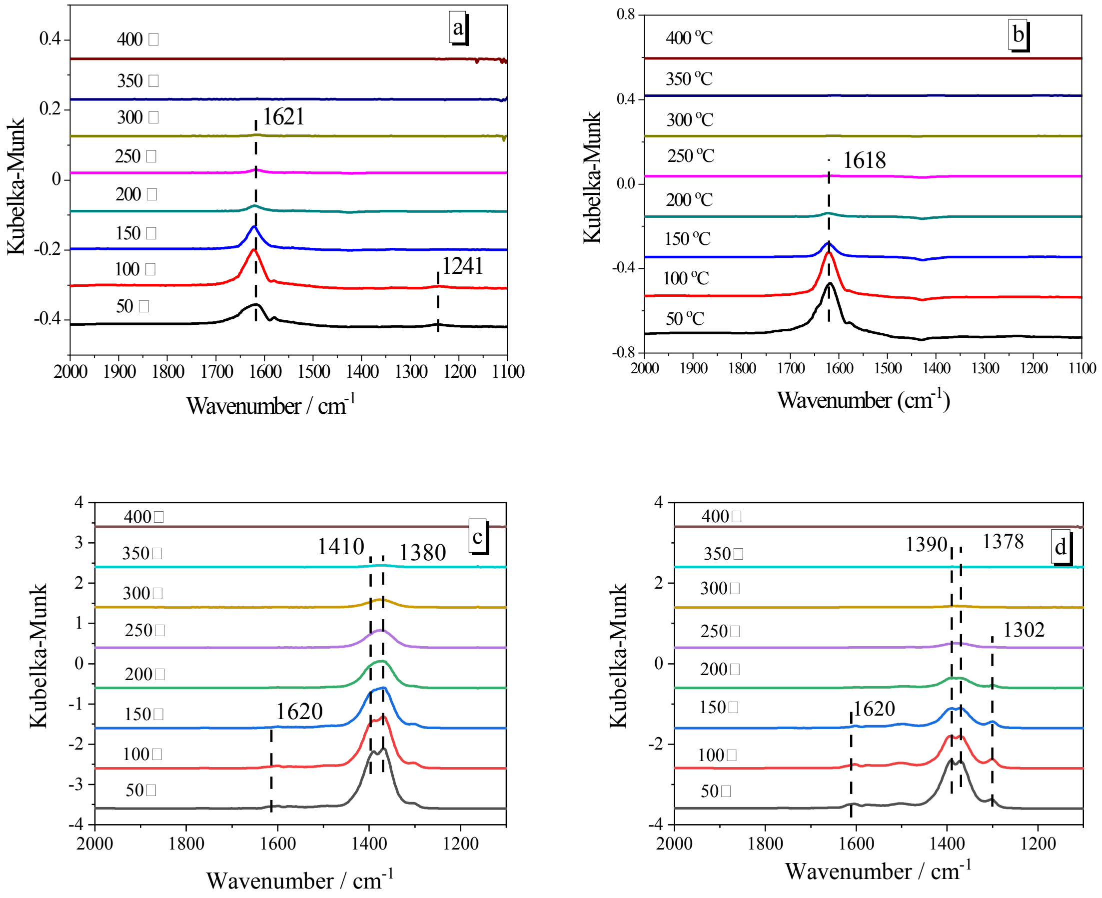


Figure S3 In situ DRIFTS spectra of $V_{0.04}W_{0.03}Mo_xSb_y/TiO_2$ treated in 500 ppm NO and 6 vol.% O_2 at room temperature for 1 h and then purged by N_2 at different temperatures: (a) $V_{0.04}W_{0.03}/TiO_2$; (b) $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.018}/TiO_2$; (c) $V_{0.04}W_{0.03}/TiO_2$-K and (d) $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.018}/TiO_2$-K

The NO+O_2 adsorption on the $V_{0.04}W_{0.03}/TiO_2$ and $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.018}/TiO_2$ catalysts was studied by in-situ DRIFTS at 180 °C, and the results are shown in Fig. S3. Two vibration bands were observed at 1621 cm^{-1} and 1241 cm^{-1} over $V_{0.04}W_{0.03}/TiO_2$. The band at 1621 cm^{-1} was attributed to the weak adsorption of NO and NO_2, while the band at 1257 cm^{-1} was due to the bridged nitrate [5-6]. It was noteworthy that the intensity of bands was noticeably weakened as the temperature increased. As exhibited in Fig.S3(b), more adsorbed NO species could be observed on $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.018}/TiO_2$ catalysts. Similarly, the intensity of the band at 1618 cm^{-1} (NO_x species) gradually decreased and almost disappeared at 200 ℃. Fig. S3(c) and (d) showed the results of NO adsorption on the $V_{0.04}W_{0.03}/TiO_2$-K and $V_{0.04}W_{0.03}Mo_{0.015}Sb_{0.018}/TiO_2$-K catalyst. The difference was that more nitrate adsorption bands appeared at 1390, 1380 and 1302 cm^{-1} [7]. The results of Fig. c showed that intensity of the bands attributed to adsorbed NO_x species decreased slowly with increasing temperature and remained at 350°C, which indicated that nitrate could stably exist on the catalyst surface.

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