Chinese researchers achieve important progress in the study on the interface chemistry of environmental pollution control

With the support of the National Natural Science Foundation of China, the group led by Prof. Zhan SiHui's (展思辉) from the College of Environmental Science and Engineering of Nankai University in China has achieved important progress in the study on the interface chemistry of environmental pollution control. The relevant results were published in *Angew Chem Int Ed* with the title of "The Role of Alkali Metal in α-MnO_2 Catalyzed Ammonia-Selective Catalysis" (2019, 58: 6351—6356).

Ammonia selective catalytic reduction (NH_3-SCR) is one of the most widely used and efficient technologies for the abatement of NO_x from the exhausts of stationary and mobile sources. However, alkali metal ions in the stack gases are easy to react with the active sites of the catalyst and thus change their chemical structure, which can lead to severe deactivation of such SCR catalysts.

In order to improve this disadvantage, Zhan's group at Nankai University found an unexpected phenomenon that the incorporation of K^+ in the tunnels of α-MnO_2 could greatly improve the catalytic activity at low temperatures. Results showed that K^+ in the tunnels could form a stable coordination with eight nearby O_{sp3} atoms. The columbic interaction between the trapped K^+ and O atoms can rearrange the charge population of nearby Mn and O atoms, thus making the topmost five-coordinated unsaturated Mn cations (Mn_{5c}, the Lewis acid sites) more positive. Therefore, the more positively charged Mn_{5c} can better chemically adsorb and activate the NH_3, which can greatly improve low-temperature performance in the NH_3 selective catalytic reduction.

This study not only provides an effective strategy to improve the reaction activity of the catalyst, but also demonstrates the relationship between the active sites and the catalytic activity at the atomic level, which is an interesting example for applying interface chemistry in the field of environmental pollution control.

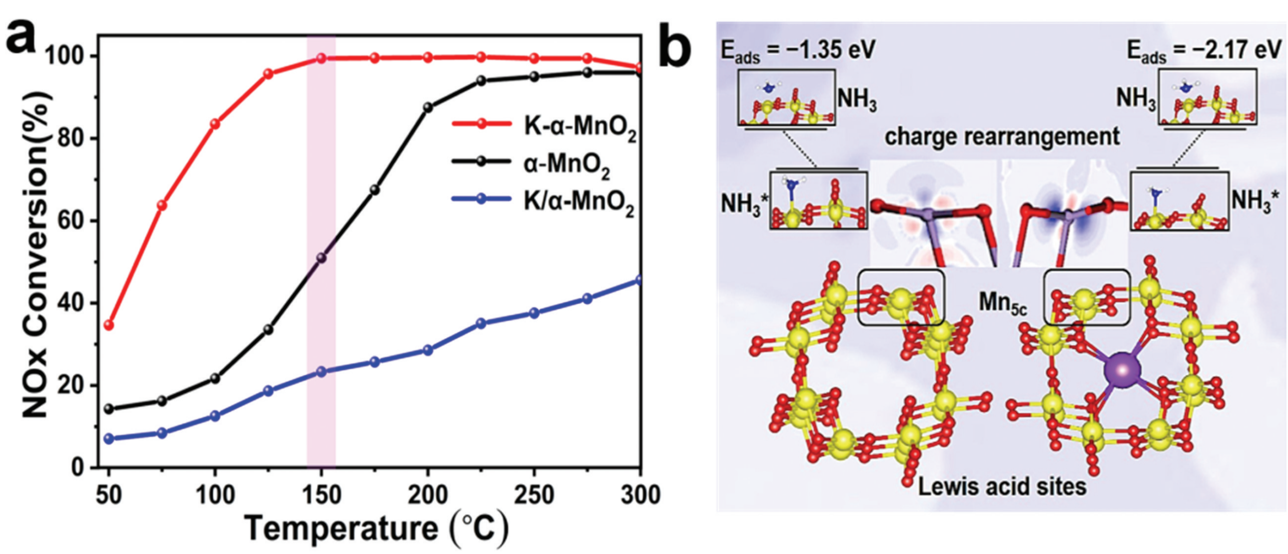

Figure Catalytic activity (a) and mechanism (b) of potassium ions inserted α-MnO_2 in NH_3-SCR.