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Does N_2O react over oxygen vacancy on $TiO_2(110)$?

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Molecular N_2O has bee known to react over oxygen vacancy on a reduced rutile $TiO_2(110)$-1×1 surface to desorb as molecular N_2 leaving oxygen atom behind. In the present study, we investigated the reaction of N_2O on rutile $TiO_2(110)$ using temperature-programmed desorption (TPD). Our results indicate that N_2O does not react over the oxygen vacancy under a typical UHV experimental condition. On a rutile $TiO_2(110)$-1×1 with a well-defined oxygen vacancy concentration of 5% ($2.6\times10^{13}/cm^2$), N_2O desorption features show a monolayer peak maximum at 135 K followed by a small peak maximum at 170 K. When the oxygen vacancy is blocked with H_2O, the N_2O peak at 170 K disappears completely, indicating that the peak is due to molecular N_2O interacting with oxygen vacancy. The integrated amount of desorbed N_2O plotted against the amount of adsorbed N_2O however shows a straight line with no offset indicating no loss of N_2O during our cycles of TPD measurements. In addition, our N_2O uptake measurements at 70～100 K showed no N_2 (as a reaction product) desorption except contaminant N_2. Also, H_2O TPD taken after N_2O scattering up to 350 K indicates no change in the vacancy-related H_2O desorption peak at 500 K showing no change in the oxygen vacancy concentration after the interaction with N_2O.

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