A temperature programmed desorption study of propene adsorption on gold islands dispersed on TiO$_2$(110).

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The adsorption of propene on TiO$_2$(110) and on gold islands dispersed on TiO$_2$(110) [Au/TiO$_2$(110)], both at 120 K, has been studied using temperature programmed desorption (TPD). Propene physisorbs on both TiO$_2$(110) and Au/TiO$_2$(110), with desorption peak temperatures of 189 and 241 K, respectively, for a dose of 0.001 L propene. When 17% of the TiO$_2$(110) surface is covered by gold islands[17% Au/TiO$_2$(110)], a dose of more than 0.001 L does not increase the intensity of the existing peak, but causes a new feature at 180-190 K to appear, which grows larger with increasing propene dose. However, with 84% Au/TiO$_2$(110), this feature at 180-190 K does not appear in the TPD spectra with propene doses as large as 0.02 L. Since the saturation dose of propene is related to the gold island coverage, the desorption peak at 241 K is attributed to propene desorption from gold islands while the new feature that appears at 180-190 K is attributed to propene desorption from the TiO$_2$(110) surface. For the 0.001 L dose of propene, the TPD of propene/17% Au/TiO$_2$(110) shows no 180-190 K feature. This shows that all of the propene desorbs from gold islands. Since some propene molecules must initially physisorb on TiO$_2$(110) sites, but no propene molecules desorb from these sites during TPD, the propene must be mobile enough on the TiO$_2$(110) surface, either at the dosing temperature or during TPD, to physisorb at sites on the gold islands.