

ADSORPTION DYNAMICS OF WATER ON THE SURFACE OF TiO₂ (110)

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Abstract. Rutile titanium dioxide TiO₂ is used in a number of technological areas. Therefore, in surface science, it has become the most studied oxide surface, and it is generally used to model the TiO₂ catalytic properties under ultra high vacuum conditions. While water adsorption on rutile TiO₂ (110) has been mainly investigated using scanning tunneling spectroscopy (STM), we use here a different approach based on the work function spectroscopy (WF): water adsorption induces formation of a dipole layer which locally changes the work function. The change can be experimentally monitored by the onset shift of the energy spectrum of secondary electrons. Although X-ray photoelectron spectroscopy is not sensitive enough to monitor water adsorption on TiO₂ having low defect concentration, WF results clearly show the work function change which is undoubtedly attributed to the water adsorption. These measurements were done for different water vapour pressures, exposure times, sample temperatures and general surface conditions. Time evolution of the work function change, together with that of the H₂O partial pressure, enable us to successfully model the adsorption dynamics and help us understand the observed results. This analysis clearly shows existence of at least three different adsorption mechanisms. The interplay between them governs the measured time evolution of the work function change. Their relative contributions depend on the surface temperature and, presumably, its topography. These results will be discussed in the light of several recent experimental (mainly using STM) and theoretical studies of this system done by other authors.

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