

Surface structure of superhydrophilic titania: wet chemically prepared TiO₂(110) and TiO₂(011)

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Ever since the discovery that UV irradiation of titania results in a superhydrophilic surface, there has been a great deal of effort to both exploit and understand this novel phenomenon. Significant success has been achieved in the former of these two goals, with applications including self-cleaning windows and anti-fogging mirrors. In contrast, uncertainty still remains as to the origin of the superhydrophilicity. Currently, there are a number of potential explanations to be found in the literature, but none are supported by compelling experimental evidence. For example, it is proposed that the superhydrophilicity is simply a result of the removal of surface carbon contamination. Other researchers suggest that modification of the surface structure/chemistry of the titania substrate underpins this macroscopic property. Longer range structural changes are also purported to be important, including the formation of nanoscale hydrophobic and hydrophilic domain. In this presentation, we will discuss our efforts to address this topic through the application of surface X-ray diffraction to reveal the atomic scale structure of two superhydrophilic titania surfaces, i.e. rutile-TiO₂(110) and rutile-TiO₂(011), that have both been prepared with a wet-chemical approach. Comparing their structures with previous studies suggests that the superhydrophilicity of titania is most likely to be a result of the depletion of surface carbon contamination, coupled with extensive surface hydroxylation.