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Preparation of atomically flat TiO_2(001) surfaces[1] YANG WANG, Oak Ridge National Lab, HANNO H. WEITERING, University of Tennessee, Knoxville, PAUL C. SNIJDERS, Oak Ridge National Lab — Transition metal oxides with the rutile structure (MO_2, M= e.g. Ti, V, or Nb) have highly directional partially occupied t_{2g} orbitals. Some of these orbitals form quasi-1D electronic bands along the rutile c-axis, and Peierls-like ordering phenomena have been observed in VO_2 and NbO_2. Tailoring the electronic properties of these materials *via* quantum confinement requires epitaxial growth on suitable substrates such as low index TiO_2 surfaces. Because of the high surface energy of rutile TiO_2(001), the standard approach of sputtering and annealing usually introduces faceting. Here we demonstrate a facile method to create atomically flat, non-faceted TiO_2(001) surfaces. Using scanning tunneling microscopy we observe terraces with a width of approximately 150 nm. Step heights of approximately 0.3 nm are observed, consistent with the c lattice parameter of rutile TiO_2. Low energy electron diffraction patterns reveal sharp diffraction spots with an in-plane lattice constant of 0.358 nm which is consistent with a (1x1) ordering of the (001) plane. These TiO_2(001) single crystal surfaces can serve as an ideal substrate for further growth of rutile heterostructures.

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Paul Snijders
Oak Ridge National Lab

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