Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Exploration of Controlled Nitrogen Doping of TiO_2 Single Crystalline Thin Films ELI SUTTER, ROBERTO DUCA, PERCY ZAHL, PETER SUTTER, Brookhaven National Laboratory — TiO_2 is a promising material for many photochemical applications, notably the direct conversion of solar energy into chemical (H_2) via photocatalytic splitting of water. One of the biggest challenges to incorporating TiO_2 into a practical device is developing accessible routes to reliably dope TiO_2 with impurities like C, N, or B that will extend the photoactivity of TiO_2 from the UV into the visible part of the solar spectrum. Fundamental studies of the doping and the resulting changes in photocatalytic properties require well-defined model systems, such as bulk-doped single crystalline TiO_2. We present results on in situ N-doping of single crystalline TiO_2 films during homoepitaxy on rutile TiO_2(110) using reactive magnetron sputtering. NO_2 is injected into the plasma to achieve bulk doping of the TiO_2 films. The doped film morphology and near-surface electronic structure is studied in situ by scanning tunneling microscopy, without any treatment that might affect the dopant distribution. Analytical transmission electron microscopy is used to map film structure, defects, and interfaces, and determine the doping profile.

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Date submitted: 30 Nov 2006 Electronic form version 1.4