Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Visible Light Sensitization of TiO_2 Films by co-doping with Nitrogen and Carbon INCI RUZYBAYEV, EMRE YASSITEPE, University of Delaware, AWAIS ALI, ARSHAD S. BHATTI, COMSATS Institute of Information Technology, SYED ISMAT SHAH, University of Delaware — Anatase phase of TiO_2 has a band gap of 3.20 eV. Therefore, only UV light can be absorbed from the solar spectrum. Introducing defect states narrows the band gap of TiO_2 semiconductor and enhances the visible light activity. In this study, the defect states in the band gap are created by nitrogen and carbon dopants. Reactive pulsed laser deposition technique is used to prepare nitrogen and carbon co-doped TiO_2 films. Total pressures of nitrogen and methane gases are kept at 100 mTorr. Two types of co-doped samples are investigated with partial pressures of 80 mTorr nitrogen with 20 mTorr methane and 20 mTorr nitrogen with 80 mTorr methane. Undoped, control, sample is also prepared under 100 mTorr oxygen gas. All films show polycrystalline anatase structure. Nitrogen dopant is calculated from XPS high resolution scans while carbon incorporation into TiO_2 lattice is supported by XRD and FESEM analyses. Also, direct relation between oxygen vacancies and nitrogen doping concentration is observed from XPS high resolution scans of N 1s and Ti 2p regions. Band gap is calculated using absorption coefficient obtained from UV-Vis diffuse reflection spectroscopy measurements. 80 mTorr nitrogen and 20 mTorr methane co-doped TiO_2 film has the lowest band gap among all with 2.17 eV which lies near the most intense peak in the visible part of the solar spectrum. Therefore, co-doping TiO_2 with nitrogen and carbon is a possible method for visible light sensitization.

Inci Ruzybayev
University of Delaware

Date submitted: 09 Nov 2012 Electronic form version 1.4