Abstract Submitted
for the NWS19 Meeting of
The American Physical Society

The optical signatures of amorphous TiO_2 thin films[1] PATRICK BERRY, OKAN AGIRSEVEN, JAMES HAGGERTY, DAVID RIVELLA, RYAN LANCE, JANET TATE, Department of Physics, Oregon State University — Reflection and transmission spectra of amorphous thin films of TiO_2 reveal significant differences that are related to the oxygen pressure during sputter deposition. The onset of strong absorption, which is related to the semiconductor band gap, is at lower energy in amorphous films deposited at lower oxygen partial pressure than for films deposited at higher oxygen partial pressure. In addition, the lower pO_2 films have significantly stronger absorption in the near infrared, which may be caused by free-carrier absorption. Upon rapid annealing at 400C, these amorphous films crystallize into one of three polymorphs of TiO_2, rutile, brookite, and anatase, and the resulting polymorph is strongly correlated with the oxygen deposition pressure. The signature of the strong absorption onset is retained in the crystalline films. The low-energy absorption decreases in all films as the oxygen content increases upon annealing, but rutile remains slightly absorptive, while absorption disappears in anatase. Optical absorption spectroscopy is therefore a viable means of distinguishing amorphous precursor films from one another and for predicting the crystalline polymorph that results from annealing.

[1]This work was supported as part of the Center for Next Generation Materials by Design: Incorporating Metastability, an Energy Frontier Research Center funded by the U.S. Department of Energy, Office of Science, Basic Energy Sciences under Award DE-AC36-08GO28308.

Janet Tate
Oregon State University

Date submitted: 18 Apr 2019 Electronic form version 1.4