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Amorphous to Crystalline Polymorphic Behaviors of TiO_2 Thin Films Deposited Under Various Oxygen Pressures by Pulsed Laser Deposition[1] OKAN AGIRSEVEN, JAMES E. S. HAGGERTY, JANET TATE, Oregon State University, LAURA T. SCHELHAS, MICHAEL F. TONEY, Stanford Synchrotron Light Source, LAUREN GARTEN, JOHN PERKINS, DAVID S. GINLEY, National Renewable Energy Laboratory, JOHN S. MAGNUM, BRIAN P. GORMAN, Colorado School of Mines, DANIIL KITCHAEV, Massachusetts Institute of Technology, WENHAO SUN, GERBRAND CEDER, Lawrence Berkeley National Laboratory — TiO_2 is a versatile wide bandgap transparent semiconducting oxide with three well known polymorphs: Anatase, rutile and brookite. The crystalline polymorphs of TiO_2 require high temperature annealing processes to form from an amorphous precursor. Our research aims to understand the formation behaviour of these metastable polymorphs of TiO_2 as related to amorphous precursor properties. In this study, TiO_2 thin films deposited at room temperature on a-SiO_2 substrates by PLD under different oxygen pressures and then annealed with same annealing process. Changing the oxygen pressure for each deposition resulted in different phase structures after the annealing processes. We found that lower pressure favors rutile, middle pressure favors brookite, and higher pressure favors anatase formation. Microstructural properties of TiO_2 thin films are investigated by XRD, Raman spectroscopy, SEM, XPS, and optical transmission and reflection spectroscopy.

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