PO3067

Structural phase-dependent resistivity of Nb-doped titanium dioxide (TiO2:Nb) thin films

Gloria Gottardi[1], Kashif Safeen[2], Nadhira Laidani[1], Victor Micheli[1], Ruben Bartali[1]

[1]Fondazione Bruno Kessler, Trento, Italy [2]Abdul Wali Khan University, Mardan, Italy

ggottard@fbk.eu

Recently, Niobium doped titanium oxide (Nb-doped TiO_2) emerged as a potential indium-free transparent conducting oxide material due to its low resistivity and high visible transparency, with source materials being inexpensive and nontoxic.
In the present work we studied the correlation between Nb-doped TiO_2 thin films' conductivity and their cristalline structure. In particolar we demonstrated that a fine control on the amount of anatase phase with respect to rutile one is critical for achieving low resistivity values. The films with various levels of Nb in corporation were grown by RF sputtering at 200 °C and then annealed at 400 °C. The resistivity values of the films doped with oxygen vacancies and Nb+5 decreased from 3.8×10−1 to 4.1 × 10−3 Ω cm when the weight percent of rutile in anatase-rutile phase mixture decreases from 52.8% to 32%. Furthermore, the lowest resistivity value of 2.37 × 10−3 Ω cm was obtained for the doped TiO2 films having single phase anatase structure. The physical processes responsible for the diverse electrical properties are discussed and are associated with the growth conditions, in particular the growth temperature.

Keywords
Transparent conductive oxides
RF sputtering
structure