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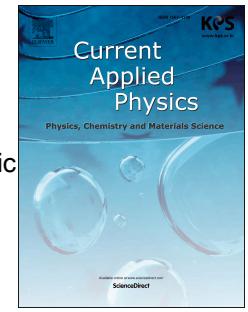

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Effect of Electrochemical Reduction on the Structural and Electrical Properties of Anodic TiO_2 Nanotubes

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Abstract

The effect of electrochemical reduction on the structural and electrical properties of amorphous as well as annealed TiO_2 nanotubes (TNTs) is investigated under ambient conditions. TNTs were prepared by anodizing titanium sheet in ethylene glycol electrolyte containing NH_4F and de-ionized water at 40 V for 6 h. Electrochemical reduction is carried out in 1 M aqueous KOH solution for ~15 second at 3 V. TNTs are characterized by SEM, XRD, XPS and impedance spectrometer. XRD results confirm an increase in d-spacing for (101) and (200) planes, after electrochemical reduction. XPS data reveal that electrochemical reduction produced prominent shifts of ~0.7-1.0 eV in the binding energies of TNTs. Interestingly, these shifts recover completely (in case of amorphous TNTs) and partially (in case of anatase TNTs) within ~ 7 days after reduction process due to oxygen uptake. Partial recovery in the binding energies of anatase TNTs is due to the fact that the oxygen vacancies