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PECVD preparation of TiO2 thin films in surfatron generated plasma

Jiri Olejnicek[1], Zdenek Hubicka[1], Jiri Smid[1], Petra Ksirova[1], Michaela Brunclikova[1], Stepan Kment[2], Martin Cada[1]

[1]Institute of Physics, ASCR, Prague, Czech Republic [2]Palacký University, RCPTM, Joint Laboratory of Optics, Olomouc, Czech Republic

olejn@fzu.cz

Titanium dioxide (TiO2) is very promising material because it is an efficient, environmentally friendly, and relatively inexpensive photocatalyst. This work deals with plasma-enhanced chemical vapour deposition (PECVD) of TiO2 thin films from titanium IV isopropoxide (Ti(O-i-C3H7)4) (or TTIP) in pure argon or Ar/O2 mixture. As a plasma source, multi plasma jet system with 4 independent nozzles working at reduces pressure on the principle of surface-wave discharge (SWD) was used. The surfatron source was powered by a microwave magnetron generator working at a frequency of 2.45 GHz with the output power in the range 50 - 300 W per surfatron. Liquid TTIP was stored in bubbler, which was placed in temperature-controlled water bath. The temperature of precursor during experiments was varied between 20 and 60°C. TTIP vapour was carried into the reactor chamber nearby the quartz tube outlet using controllable argon flow-rate in the range 10-150 sccm. In this configuration the set of TiO2 samples with various thicknesses was deposited on cold or heated quartz substrate, electrically conductive ITO (Indium Tin Oxide) coated glass substrates and on polycarbonate foil. Prepared samples were analysed using X-Ray Diffraction in standard Bragg-Brentano geometry, Raman spectroscopy, Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray Spectroscopy (EDX), UV-light amperometry and optical ellipsometry. Depending on substrate temperature all as-deposited samples were amorphous or revealed anatase crystal structure. Later annealing treatment led to pure anatase phase. All samples under study were photo-electrochemically active. The influence of all deposition parameters (precursor temperature, precursor flowrate, absorbed power, substrate temperature and oxygen partial pressure) on thin films properties and deposition rate was studied in detail.

Keywords
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water splitting
thin film