Temperature Assisted Tuning of CdTe Nanocrystal Deposits On TiO2 Nanotubes Under Solvothermal Conditions

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Abstract

The in-situ formation of chalcogenide nanocrystals on anodized oxide walls using a solvothermal approach has been presented. CdTe deposits on anodized TiO_2 nanotube (T_NT) walls have been prepared and characterized using surface, optical, and photoelectrochemical techniques. It has been shown that the solvothermal reaction temperature can be changed to tune two critical properties of the CdTe films: nanocrystal size and density of coverage. The size of the crystals demonstrates a temperature dependent variation from 3.74 nm to 7.12 nm. The optimal temperature for uniform growth was noted to be in between 180-200ºC. All T_NT/CdTe composites demonstrate photoelectrochemical activity in the presence of UV-visible light and 0.5M Sodium sulfide as the electrolyte. To measure the photoelectrochemical activity, Ag/AgCl/3.4M KCl was used as the reference electrode and Pt as the counter electrode. The highest photocurrent response was noted with CdTe prepared at 200ºC: an increase of 370% with respect to T_NT.