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Highly Ordered TiO2 nanotubes on pattered Si substrate for sensor applications

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Anodic titanium dioxide (TiO2) nanotubes are very attractive materials for gas sensors due to its large surface to volume ratios. The most widely known method for fabrication of TiO2 nanotubes is anodic oxidation of metallic Ti foil.

Since the remaining Ti substrate is a metallic conductor, TiO2 nanotube arrays on Ti are not appropriate for gas sensor applications. Detachment of the TiO2 nanotube arrays from the Ti Substrate or the formation of electrodes onto the TiO2 nanotube arrays have been used to demonstrate gas sensors based on TiO2 nanotubes. But the sensitivity was much lower than those of TiO2 gas sensors based on conventional TiO2 nanoparticle films. In this study, Ti thin films were deposited onto a SiO2/Si substrate by electron beam evaporation. Samples were anodized in ethylene glycol solution and ammonium fluoride (NH4F) with 0.1wt%, 0.2wt%, 0.3wt% and potentials ranging from 30 to 60V respectively. After anodization, the samples were annealed at 600^{o}C in air for 1 hours, leading to porous TiO2 films with TiO2 nanotubes. With changing temperature and CO concentration, gas sensor performance of the TiO2 nanotube gas sensors were measured, demonstrating the potential advantages of the porous TiO2 films for gas sensor applications. The details on the fabrication and gas sensing performance of TiO2 nanotube sensors will be presented.

Keywords: Anodic oxidation, Gas sensor, TiO2 nanotubes