Controlled Directional Growth of TiO2 Nanotubes

We demonstrate how the anodization direction and growth rate of vertically aligned, highly ordered TiO2 nanotube (NT) arrays can be controlled and manipulated by the local concentration of O-2 in the electrolyte. This leads to the growth of highly active TiO2 NT arrays directly on nonconducting substrates in a single step. By controlling the oxygen concentration, the electrical contact to the titanium film can be preserved until the entire film is anodized. This approach to growing transparent TiO2 NT films yields possibilities for using glass without any transparent conducting oxide coating as substrates. The role of molecular oxygen on the anodization and the means necessary for controlling the growth direction were investigated through the use of labeled oxygen and concentration gradient experiments.