A novel method using Electrodedeposition for titania(TiO_2) nanotubes synthesis

Hyung-Kee Seo[1,2]*, Gil-Sung Kim[1], S. G. Ansari[1], Young-Soon Kim[1], Hyung-Shik Shin[1]

[1]Chonbuk National Univ. Chemical engineering Dept. [2]SPRC(semiconductor process research center)

* E-mail : enterpride2@chonbuk.ac.kr

Past decade has witnessed a tremendous increase in the research activity in the field of renewable energy sources viz solar cells, because of soaring oil price and increasingenvironmental concern [1-2]. Amongst these sources, solar power has two major advantages over fossil fuels. The first being a permanent non-pollutant energy source and the second is its effect on the environment in comparison with the fuels cells which introduces many harmful pollutants by burning the fossils.

Kasuga et al. were the first to synthesize titania (TiO_2) nanotubes with diameters of about 8 nm and lengths of about 100 nm in NaOH solutions through hydrothermal synthesis [3]. This was the first configuration of a one dimensional titania material. This is not difficult method in which titania particles, primarily nanoparticles are treated in sodium hydroxide solutions at moderate temperatures, and for sufficient amount of time. It is, however, realized that the substantial amount of sodium (Na) gets incorporated in these nanotubes. The walls of these nanotubes are believed to have layered structure, although the structure similar to sodium titanates overall crystallinity is not very high possibly due to presence of sodium. Evidently, the presence of sodium in such nano-sized titania material is expected to deteriorate properties rendering lower efficiency of material in given applications. In the present work, we report for the first time, a novel method of removal of sodium via electrodeposition process. In this study, titanate nanotubes are synthesized using hydrothermal method from commercial titania powder (P25) followed by room temperature cotaing of titanate film by eclectrodeposition at an applied volatge of 80V DC. Na contained is substantial in as-synthesized titanate nanotubes. However, electrodeposition leads to a a Na free-film. The elemental analyses showed that the intercalated sodium is removed drastically while electrodeposition.

Reference

1. Z. L. Wang, Adv. Mater. **10**, 13 (1998).
2. Xia, P. Yang, Y. Sun, Y. Wu, B. Mayers, B. Gates, Y. Yin, F. Kim, and H. Yan, Adv. Mater. **15**, 353 (2003).
3. T. Kasuga, M. Hiramatsu, A. Hoson, T. Sekino, K. Nihara, Langmuir **14**, 3160 (1998).