NW-P014

Novel Photocatalytic and Antibacterial Activities of Three-Dimensional (3D) Polycrystalline Anatase TiO2 Structures

Hyun Uk Lee[1], Hyung Joong Yun[1], Byoungchul Son[2], Jung Hye Seo[1], Hyeran Kim[1], Saehae Choi[3], Cheolho Jeon[1], Hae Jin Kim[1], Jouhahn Lee[2]*

[1]Division of Materials Science, Korea Basic Science Institute, Daejeon 305-333, [2]Jeonju Center, Korea Basic Science Institute, Jeonju 561-756, [3]College of Pharmacy, Chungbuk National University, Cheongju 361-763, Korea

We report three-dimensional polycrystalline anatase TiO2 structures (3D a-TiO2) for environmental and bio-medical applications. The 3D a-TiO2 was synthesized without thermal treatment by the growth of rod-like polycrystals on Degussa P25 (P25) via low temperature (<85 °C) modified alkali hydrothermal processing. X-ray diffraction and high-resolution transmission electron microscopic results showed that the rod-like polycrystals of 3D a-TiO2 possessed the highly anatase nanostructures. The photocatalytic activity of 3D a-TiO2 was found to be 2.2 times higher than that of P25. The recyclability of the 3D a-TiO2 was found to be high: the decolorization rate was 94.8% of the initial value after fifteen cycles. In addition, 3D a-TiO2 exhibited excellent antibacterial activities for the sterilization of gram-negative Escherichia coli (E. coli) and gram-positive Staphylococcus aureus (S. aureus). Even at the 10th recycled use, more than 98.4% of E. coli and S. aureus can be killed. These results indicated that 3D a-TiO2 might have utility in several promising applications such as photocatalytic water/air purification and bactericidal agents.

Keywords: Titanium dioxide, Photocatalyst, Hydrothermal treatment, Photocatalytic activity