Junior Science Communications
Faculty of Applied Sciences, UiTM Shah Alam
https://journal.uitm.edu.my/ojs/index.php/JSC

E-ISSN 2637-0689
Vol 37 2024

Colloquium on Applied Sciences 2024
19-21 January 2024, Faculty of Applied Sciences, UiTM Shah Alam, Malaysia

Effect of Concentration and Voltage on the Growth Formation of TiO2 Nanotubes

Muhammad Amin Mohd Nasir[a], Nur Aimi Jani[ab*]

Structured Abstract

Background: Every year, due to inadequate practice of some manufacturers, many harmful dyes are released into the water stream. Photocatalysis is the most preferred technique to remove these dyes, while TiO_2 is one of the most regarded materials for the photocatalyst. There are several methods to fabricate Ti to TiO_2. The fabrication methods are mostly nanoparticle-based fabrications such as CVD, sol-gel, and hydrothermal. However, the nanoparticles tend to agglomerate with each other. As a result, this phenomenon lowers photocatalytic performance of TiO_2. Therefore, this research will use the anodization method to produce structures with less tendency to agglomerate, like nanotubes. The principle of anodizing is to use electricity to create a thin layer of oxide on the surface of a metal part, then the F^- ions will etched it to form pits before growing into nanotubular structure. Anodization parameter, applied voltage, and concentration are chosen as they directly influenced the morphology of the TiO_2. Applied voltage affects NTs diameter meanwhile, concentration affects NTs arrangement.

Methods: The NTs will be fabricated using anodization methods in electrolytes containing ethylene glycol + NH_4F + DI water. In this study, the two-step anodization was conducted. Samples were annealed at 450°C for an hour before characterized with FESEM, XRD and DRS.

Results: This study successfully optimized the controlled parameter, electrolyte concentration and applied voltage. The morphological properties of TiO_2 NTs with concentration of 0.2wt% and 30V parameter showed a highly ordered and well-dispersed NTs. While the structural characterization showed that 0.3wt% and 50V have a high anatase crystallinity for respective parameters. DRS characterized the optical properties and found that 0.3wt% and 40V have the narrowest energy band gap of 3.04 eV and 3.00eV for their respective parameters

Conclusion: In conclusion, the optimum electrolyte concentration from the study is 0.2wt% for its highly ordered and well-dispersed NTs, while for applied voltage is 40V for narrow energy band gap of 3.00 eV.

Keywords: TiO_2 NTs, Anodization, Formation Growth

*Correspondence: nuraimi_jani@uitm.edu.my

[a] School of Chemistry & Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia

[b] Industrial Waste Conversion Technology Research Group, Universiti Teknologi MARA, Shah Alam, Malaysia