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Effect of electrolyte aging on the morphology and mechanical properties of anodic titanium dioxide

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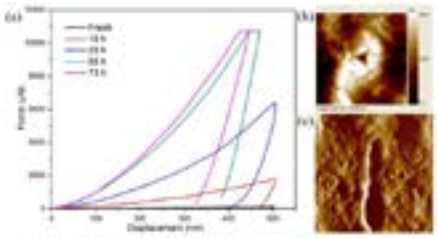
Titanium dioxide (TiO_2) has attracted extensive attention as multifunctional semiconductors in various applications, such as sensors, photocatalysis and medical devices. Electrochemical anodization is a simple and cost-effective way to produce one dimensional TiO_2 nanotubes with large surface area and tunable morphology. Recently great efforts have been made on understanding the formation mechanism behind the regular morphology and influencing anodization parameters. However, rare studies were reported focusing on the mechanical properties of anodic TiO_2, such as hardness, modulus and adhesion, which are vital to practical application of TiO_2. The purpose of this study is to explore the effect of electrolyte aging on the morphology and mechanical properties of anodic TiO_2 nanotube arrays. Electrochemical anodization of titanium foil was conducted in different aging electrolyte to produce regular self-organized TiO_2 nanotube arrays. Nano indentation test was then performed on as synthesized TiO_2 nanotube surface to measure their mechanical properties. The regularity of obtained TiO_2 nanotube improves in short aging electrolyte while deteriorates in long aging electrolyte with pore size decreasing from 146.58 nm to 46 nm. However, the hardness and reduced modulus increase with prolonging aging time as well as adhesion strength. The electrolyte aging has a significant role in the morphology and mechanical properties during titanium anodization. It improves the hardness, modulus and tribological behavior of anodic TiO_2 nanotube arrays, but reduces their pore size and surface area. Therefore, the proper aging time of electrolyte should be selected according to the specific applications.



Recent Publications

1. J Dong, et al. (2018) Enhancing photocatalytic activities of titanium dioxide via well-dispersed copper nanoparticles. Chemosphere 204:93-201.
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3. J Dong, et al. (2017) Patterned titania nano structures produced by electrochemical anodization of titanium sheet. International Journal of Modern Physics B 31:1744049.
4. J Dong et al. (2016) Self-organized ZnO nanorods prepared by anodization of zinc in NaOH electrolyte. RSC Advances 6:72968- 72974.
5. J Dong, R Ullal, J Han, S Wei, X Ouyang, J Dong and W Gao (2015) Partially crystallized TiO_2 for microwave. Journal of Materials Chemistry A 3:5285.

Biography

Junzhe Dong has completed his Bachelor's degree in Materials Physics at Southwest University, China in 2011. Then he went to Northwestern Polytechnical University, China for research project on Ti alloy deformation. He has completed his PhD in "Transition metal oxides and their applications" at University of Auckland, New Zealand. He has expertise in Micro and Nano Indentation Test, Electrochemical Anodization Technique, Raman Signal Enhancement and Photocatalysis.

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