

Simple fabrication of anatase nano structures on stainless steel surface

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Introduction -Attaching nano structures on to stainless-steel (SS) mesh surface can be advantageous due to higher surface area, low cost, chemical stability, electrical conductivity, flexibility, and heterojunction effect at the iron oxide-anatase interface. Most of procedures that has been followed for synthesizing nanostructures are hydrothermal or sol-gel methods consume time and energy considerably. In this study, a simple and fast procedure that can be used to synthesize various anatase nano structures on stainless-steel mesh surface and, dependance of the morphology of nano structures on some of the parameters: Temperature, humidity, titanium precures, additives, solvents were studied.

Methodology -In the common procedure, first titanium precures were dispersed in solvents. Then the mesh was dipped in the solvent and allowed to evaporate the solvent from the SS mesh surface while react with atmospheric water. After that the mesh was annealed at high temperature for three hours. Finally, the annealed mesh was characterized by SEM, Raman spectrometer and BET analysis. Above procedure was repeated with different chemical compositions (titanium precursors, solvents, and additives) and physical and experimental conditions (reacting temperature, humidity, annealing temperature, concentration of precursor, dipping number). Here titanium tetraisopropoxide (TTIP) and titanium tetraisobutoxide were used as precursors while ethanol, n-propanol, n-butanol, hexane, dimethylformamide (DMF) and xylene were used as solvents. The effect of additives: triton x100,

cetyltrimethylammoniumbromide, and NH₄F was investigated using TTIP as the precure and ethanol as the solvent. TTIP in ethanol mixture was used to investigate the effect of different physical and experimental conditions on morphology.

Results- Table 1 summarizes the effect of physical and experimental condition. Also, it was observed that formation of nanocoating with n-propanol and n butanol, nano porous structure with xylene, and a sheet like structures with DMF and when NH₄F was used as an additive

Table 1 Effect of physical and experimental conditions

Conditions	Particle coverage	Particle size	morphology
Precursor concentration	↑	↑	Spherical particle at corners
Dipping number	↑	↑	Spherical particle
Temperature and humidity	↑	↓	Spherical particle
Annealing temperature	NSE	NSE	NSE
surfactants	↑	NSE	inter connected particles

* NSE -No Significant Effect

Reference

1. K Nakata, A Fujisima, Journal of Photochemistry and Photobiology C: Photochemistry Reviews, 13(3), 169-189, (2012).