

A Facile Method of Producing TiO₂ Nanoparticles Through a Dusty Plasma Process

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Nanoparticles have immensely contributed in different areas such as environment, industry and medicine. Among the different nanoparticles, titanium dioxide (TiO₂) nanoparticles receive a great attention due to its versatile utility for applications such as photo catalysis, tissue engineering and antimicrobial agents. Sol-gel method is currently being explored for the production of titanium dioxide nanoparticles. The hydrolysis and subsequent condensation of a titanium precursor was found to be the mechanism behind this process. However, this process requires long reaction time and acid reagents. These factors seriously affect scalability, cost, and safety of the nanoparticles. Hence, a safer and more efficient process of producing titanium dioxide nanoparticles will be highly appreciated. In the current work, we attempt to prepare titanium dioxide nanoparticles using a new method based on the generation of dusty plasma from titanium precursor (titanium isopropoxide). More specifically, we have used a combination of titanium isopropoxide and water plasma. We hypothesize that this combination dusty plasma method produces titanium dioxide nanoparticles via the plasma polymerization of the titanium precursor. The prepared TiO₂ nanoparticles were then systematically characterized via different techniques such as Fourier Transmission Infrared Spectroscopy, X-Ray Photoelectron Spectroscopy, X-Ray Diffraction, Scanning Electron Microscopy, UV-Vis spectroscopy and Nanosight Particle-size analyzer. Results have suggested the successful formation of TiO₂ nanoparticles; also, it was found that there is time dependent effect in the growth of the nanoparticles. Taken together, these results suggest a dusty-plasma method for producing TiO₂ nanoparticles for different applications.