OR1601

Silicon dioxide coating of titanium dioxide nano particles from dielectric barrier discharge in a gaseous mixture of silan and nitrogen

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Titanium dioxide nano particles are used commonly in various applications due to their high catalytic activity. Many of these applications require subsequent treatments after the deposition of the TiO_2 particles. Some of these include thermal processing at high temperatures, e.g. roof tiles. During such procedures the nano particles transform from the catalytical highly active anatas structure to the substantially less active rutil structure. This structural change has been found to be significantly retarded when coating the TiO_2 nano particles with a closed film of SiO_2. During the thermal treatment, these films break open, revealing the underlying TiO_2. Thus, the film thickness has to be appropriate for the designated treatment subsequent to the nano particle deposition.
In this study, we present an approach of SiO_2 film deposition out of silan gas. For technical implementations, test gas containing about 2% silan in 98% nitrogen is preferred over pure silan, since much less precautions are needed. Closed films produced by dielectric barrier discharges in such mixtures of gases consist of mainly non-stoichiometric silicon nitride. The conversion of this silicon nitride layer to silicon dioxide is shown to be largely possible by subsequent plasma treatment in different atmospheres such as pure O_2, as well as in environmental air.
All studies have been carried out in an ultra high vacuum apparatus, while the plasma treatments have been carried out at atmospheric pressure.

Keywords
Metastable Induced Electron Spectroscopy
Ultraviolet Photoelectron Spectroscopy
X-ray Photoelectron Spectroscopy
Atomic Force Microscopy