# RELATIONSHIPS BETWEEN STRUCTURAL AND PHOTO-INDUCED PROPERTIES OF THE THIN SOL-GEL $TiO_2$ LAYERS

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Titanium dioxide ($TiO_2$) has been used in a wide range of well-established applications thanks to its photocatalytic activity, photo-induced properties, chemical stability as well as non-toxicity and low cost. This semiconductor oxide in thin layer or powder form has been frequently used as photocatalyst for water or air purification. The photo-induced properties of $TiO_2$ are also utilized for self-cleaning and antibacterial surface modifications. And especially, thin films as the nanostructured electrode material have evoked a great interest in fields of photovoltaics, energy storage, sensing, photoelectrocatalysis *etc.*

The nanostructured semiconductor materials with highly uniform nanoparticles could be prepared by physical (PVD), physically-chemical (PECVD) or purely chemical methods. The most commonly chemical method is the sol–gel technique utilizing the molecular templates. The main advantage of this method lies in a possibility of the nanomaterial preparation under laboratory conditions that enables tailoring material properties by preparation conditions. Nanoparticles with controlled chemical composition, size distribution, uniformity and dispersion can be readily synthesized by reverse micelles as template. The thin film can be created on substrate from liquid sol by a range of various deposition techniques (in our case dip- and spray-coating together with inkjet printing).

The deposited sol-gel $TiO_2$ films were treated at 450 °C for 4 hours. The surface properties of the calcined layers were determined by XRD, Raman spectroscopy, SEM, AFM, UV–Vis analyses and by the optical microscopy. The photo-induced properties of nanoparticulate $TiO_2$ layers were studied by electrochemical measurements combined with UV irradiation, by the photocatalytic reaction and by the observation of the contact angle change before and after activation by UV light.

The photo-induced properties depend not only on semiconductor nature but also on its structural properties like particle size, crystallographic form, surface morphology, porosity, surface area *etc.* This study is focused on relationships between structural and photo-induced properties of thin layers prepared by three various deposition techniques.

## References

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