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Photocatalytic, hydrophilic titanium dioxide prepared by direct current magnetron sputtering

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Many industrial processes, for example production of food, cosmetics or pharmaceuticals, require hygienic surfaces. Currently these are often cleaned using toxic chemicals. An alternative approach relies on the photocatalytic degradation of organic contaminants to obtain self-cleaning surfaces. Titanium dioxide (TiO_2) is a well-known photocatalyst that can be used to prepare surfaces activated by ultraviolet (UV) light.
We have developed a TiO_2 coating with exceptional properties obtained by direct current magnetron sputtering of titanium targets in an argon-oxygen-atmosphere. The surface is very hydrophilic with long-lasting water contact angles below 10°, which can be repeatedly switched to virtually zero by UV irradiation. UV-light-induced photo-degradation of methylene blue with a quantum yield above $2 \cdot 10^{-4}$ and light-induced antimicrobial activity against *Kocuria rhizophila* are shown. Furthermore the coating is visually transparent, hard (Vickers-hardness about 1100HV) and scratch-resistant making it suitable to prepare self-cleaning surfaces. The only drawback of the TiO_2 coating in case of indoor applications is the need for UV light to activate it.
Other researchers have reported that doping of TiO_2 with carbon leads to visible light photoactivity. Therefore we introduced acetylene in the deposition chamber during the preparation of TiO_2 coatings to dope them with carbon. Energy-dispersive X-ray spectroscopy confirms carbon atomic fractions of up to 15 % in the coatings. The robust mechanical properties of the coatings are retained. Currently tests on the wettability, photocatalysis and antimicrobial activity of the coatings under UV and visible irradiation are performed, and their results will be included in this presentation.
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