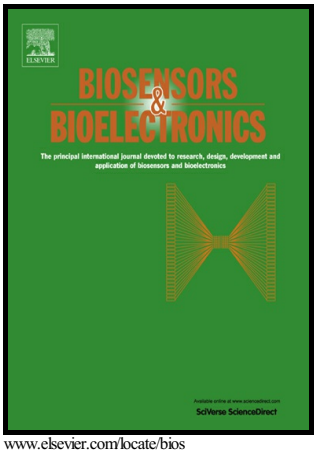


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# Titanium oxide thin films obtained with physical and chemical vapour deposition methods for optical biosensing purposes

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**Abstract:**

This work discusses an application of titanium oxide ($TiO_x$) thin films deposited using physical (reactive magnetron sputtering, RMS) and chemical (atomic layer deposition, ALD) vapour deposition methods as a functional coating for label-free optical biosensors. The films were applied as a coating for two types of sensors based on the localized surface plasmon resonance (LSPR) of gold nanoparticles deposited on a glass plate and on a long-period grating (LPG) induced in an optical fibre. Optical and structural properties of the $TiO_x$ thin films were investigated and discussed. It has been found that deposition method has a significant influence on optical properties and composition of the films, but negligible impact on $TiO_x$ surface silanization effectiveness. A higher content of oxygen with lower Ti content in the ALD films leads to the formation of layers with higher refractive index and slightly higher extinction coefficient than for the RMS $TiO_x$. Moreover, application of the $TiO_x$ film independently on deposition method enables not only for tuning of the spectral response of the investigated biosensors, but also in case of LSPR for enhancing the ability for biofunctionalization, i.e., $TiO_x$ film mechanically protects the nanoparticles and induces change in the biofunctionalization procedure to the one typical for oxides. $TiO_x$ coated LSPR and LPG sensors with refractive index sensitivity of close to 30 and 3400 nm/RIU,