The synthesis of porous nano-$\text{TiO}_2$ films on the basalt fibers

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The use of nanotechnology offers new capabilities to produce innovative materials for targeted properties, giving them a range of new applications. The photocatalytic properties of TiO$_2$ used to modify the textile materials provide the huge potential application [1,2]. In order to increase the photocatalytic efficiency the smooth TiO$_2$ films may be replaced by porous TiO$_2$ coatings [3,4].

TiO$_2$ was prepared in sol-gel technique using titanium isopropoxide, isopropanol and hydrochloric acid. To the modification of TiO$_2$ - two surfactants hexadecyltrimethylammonium bromie (CTAB) and poly (ethylene glycol) - block-poly (propylene glycol) - block-poly (ethylene glycol) (BLOK) were used. The basalt fibers (diameter 15.2±0.5 µm) with high thermal resistance were used. TiO$_2$ sol was deposited on the basalt fibers by dip – coating technique. Than the fibers were calcined to obtain photocatalytically active structure – anatase. The form of TiO$_2$ – anatase was confirmed using Raman spectrometer Renishaw InVia. The characteristics of TiO$_2$ coatings on basalt fibers using Scanning Electron Microscope Vega 3 Tescan equipped with X-ray microanalyzer EDS INCA Energy and Atomic Force Microscopy Solver P47 NT-MDT were made. The modified fibers surface and the results of Raman analysis are shown on the Fig.1.

The proposed solution allows to obtain porous TiO$_2$ films. As a consequence it caused an increase in the surface area of the photocatalyst compared to smooth TiO$_2$ film.

References
Fig. 1 The basalt fibers modified with TiO$_2$ a) smooth film, b) porous film (BLOK), c) Raman map and spectrum of modified fibers.

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