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## **Analysis of surface properties of semiconducting (Ti,Pd,Eu)O<sub>x</sub> thin films**

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### Abstract:

In this paper an analysis of the surface properties of (Ti,Pd,Eu)O<sub>x</sub> thin films prepared by magnetron sputtering has been described. In particular, the results of composition and structure investigations were studied in relation to the surface state and optical properties. It was found that (Ti,Pd,Eu)O<sub>x</sub> film was nanocrystalline and had a rutile structure. The average crystallites size was equal to 7.8 nm. Films were homogeneous and had densely packed grains. Investigation of the surface properties by XPS showed that titanium was present at 4+ state (in the TiO<sub>2</sub> form), palladium occurred as PdO<sub>2</sub> (also at 4+ state), while europium was in Eu<sub>2</sub>O<sub>3</sub> form (at 3+ state). In comparison with the unmodified TiO<sub>2</sub>, the coating with Pd and Eu additives had a rather high transparency (approx. 47%) in the visible light range, its optical absorption edge was shifted towards into the longer wavelengths (from 345 nm to 452 nm), and the width of optical energy gap E<sub>gopt</sub> was nearly twice lower (1.82 eV). Besides, the resistivity of (Ti,Pd,Eu)O<sub>x</sub> at room temperature was 1x10<sup>3</sup> Wcm. In the case of the film as-deposited on Si substrate (p-type) the generation of photocurrent as a response to light beam excitation ( $\lambda_{exc} = 527$  nm) was observed.