Formation of TiO2 Surface Structure under IR Laser Ablation of Titanium in C2H5OH (5% H2O) Liquids Environment: Prospects for Subsequent Chemical Processing of the Modified Layer

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Laser ablation in liquid is an alternative way of micro and nanostructures formation. Chemical purity of laser ablation method in ethanol is well known in literature. Nevertheless, ethanol practically always contains a small amount of water. We tested the hypothesis that laser ablation Ti in 95% ethanol lead to formation of oxide film on the metal surface. Subnanosecond multipulse Nd:YAG laser ablation of Ti in the 95% ethanol was carried out in the fluence range from 0.1 to 2 J/cm2. The irradiated Ti samples were investigated by the few methods: optical photometry, SEM, chemical etching, and the measurement of volt-ampere characteristics. Experimentally established, that laser ablation of Ti in the 95% ethanol, leads to formation of surface oxide structures. The optimal laser fluence for the effective oxidation of a titanium surface is determined by the melting threshold (~0.145 J/cm2). Measurement of the volt-ampere characteristic of Ti oxide layer has allowed to register memristive effect. Chemical etching of titanium dioxide film were carried out by using of HNO3(98%) and HF(2%) solution. After chemical etching the new type of pyramidal submicron structures were obtained. This study showed that the laser-induced Ti oxidation in liquid is not a negative result, and can be used by: sensitive pressure sensors; photocatalytic filter technique, memristive electrical.

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