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Characterization of the Ti/Al adhesion layer in thin films of Au for applications in biomedical sensors

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Gold is often used for manufacture devices due to its high electrical conductivity and optical reflectivity. On the other hand, silicon has high capability of absorb oxygen on its interface. When put together, as bilayer, the bond of gold into silicon substrate can be poor requiring an adhesion layer. Typically, oxidative metals such as chromium and titanium are used in this sense as intermediate layers, enhancing the gold adhesion. In contrast, due their oxidation and diffusion to the gold surface the electrical, structural and morphological properties can be affected substantially. Herein, we present a characterization study of a more resistant and reliable adhesion layer, composed of Ti/Al. The effects of the adhesion layer on thin film of Au/TiAl/Si deposited by magnetron sputtering are analyzed through a couple of measurements. The XRD results indicated that the films are preferentially oriented in the (111) plane exhibiting a crystal structure. A four point probe technique was used to acquire the resistivity (~ 10^{-9} Ω-m), at room temperature, for the Ti/Al alloy, showing good conductivity. The thickness of the films was estimated with Rutherford backscattering spectrometry showing a Ti/Al alloy of 60 nm with varying thickness around of 200, 300 and 900 nm for the gold top layer for different sets of films. In order to determine the Au implantation profile in Ti/Al, we calculated the Ti/Al ratio and the ion energy loss of H, He and Au in the films, also using RBS, and the results were compared to simulations obtained. Other measurements as FEG and GD-OES showed that the morphology of the film are very smooth and the interface between the films and substrate are abrupt. The set of results suggests that the Ti/Al interface could be a good alternative as adhesion layer for applications in biomedical sensors, due to its excellent conductivity, low oxidation and good durability.

Keywords
Biomedical sensors
Gold thin film
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