FABRICATION OF A MIS DIODE BASED ON TWO-DIMENSIONAL ZnO NANOSTRUCTURES BY CHEMICAL ROUTES

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Because of its physical properties, ZnO is considered a potential semiconductor compound for fabricating electronic and optoelectronic devices. In this regard, several growth techniques have been developed to ensure the required control for manufacturing commercial devices based in this semiconductor. On the pathway for improving the performance of the current devices, low-dimensional ZnO structures seem to be a promising alternative.

Here, we report the fabrication of a metal-insulator-semiconductor (MIS) diode based on ZnO nanostructures grown on the surface of an anodized aluminum substrate (ZnO/Al₂O₃/Al) by chemical routes. Namely, while the ZnO nanostructures were obtained through a low-temperature hydrothermal route, the Al₂O₃/Al substrate was obtained by electropolishing and anodizing of aluminum foil. The used electrochemical techniques for obtaining the substrate involve soft reaction conditions, short reaction times, low cost and easy processing. The obtained ZnO/Al₂O₃/Al architecture was studied by x-ray diffraction (XRD), scanning electron microscopy (SEM), micro-Raman spectroscopy (µRS) and electrical measurements. The voltage-time plot acquired during the anodizing process indicates the formation of an insulating barrier (Al₂O₃) on the metallic substrate (Al). The SEM analysis reveals that the semiconductor layer grown on the insulator film is nanostructured in nature, constituted by leave-like structures with an average thickness of ~ 50 nm. According with the Raman spectrum, these ZnO nanostructures are well-crystalline. The formation of Al₂O₃ and ZnO phases was further confirmed by means of XRD. Finally, the characteristic rectifying response of a metal-oxide-semiconductor junction is observed in the curves I-V and C-V of the obtained architecture, indicating that it is possible to build a MIS diode based on ZnO nanostructures using exclusively chemical routes.

Keywords: ZnO Nanostructures, electrochemical techniques, MIS diode

References:


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