



Iranian Journal of Physics Research, Vol. 23, No. 2, 2023
DOI: 10.47176/ijpr.23.2.11407

Study the effect of ion type on the transport properties of implanted tantalum interfaces of multilayer structures

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(Received 29 January 2022 ; in final form 21 June 2023)

Abstract

In this paper, the effect of ion type has been considered to study transport through the structures in which their interfaces have been produced by the ion implantation process. The interfaces are tantalum based and the argon and nitrogen ions have been considered at an energy of 30 keV and in different doses at ambient temperatures. For studying the surface morphology of the ion implanted rough thin films, The Atomic Force Microscopy (AFM) analysis has been used. The average roughness has been determined. Decreasing the transmission probability is the main outcome of the rough interfaces/samples. The results show that the interfaces which have been produced by argon ion implantation are rougher than nitrogen cases. Also, the peak to valley ratio reduces in two cases. Moreover, with increasing nitrogen ion doses, the current density has been reduced as a function of voltage. As it is predicted, the transmission probability decreases because of the rough interfaces which have been generated by ion implantation process. As a consequence of the scattering process (because of the interfacial roughness), the resonant tunneling peak current decreases and also, the peak to valley ratio (PVR) reduces. The samples which were prepared by argon ion implantation were rougher than nitrogen ones. Also, with increasing the nitrogen ion doses, the current density has been decreased as a function of voltage.

Keywords: tantalum thin film, roughness

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