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Measurement of Efficient Thickness of Transition Layer, Stimulated by Microwave Radiation, in Contacts Mo–GaAs

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Abstract—Using method of Auger electronic spectroscopy, we experimentally research an influence of microwave treatment on efficient thickness modification in transition layer of Mo–GaAs contacts. It is shown that parameters of Schottky barriers (barriers height φ_B and ideality factor n) are correlated with efficient thickness of transition layer after microwave treatment.

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INTRODUCTION

Semiconductor structures with Schottky barrier are basic objects for research of fundamental material properties, and for SHF devices development. Most elements of current solid-state electronics are barrier structures. Therefore one of the most important physical-technological problems is increase of reproducibility and stability of parameters of semiconductor devices with Schottky barrier. Schottky barriers parameters are dependent on physical-chemical properties of contacting metals, semiconductors surface characteristics and technological processes modes. Application of microwave treatment, as it was shown in papers [1–7], allows controlling physical-chemical properties and having an influence on contacts parameters; these treatment can be applied in technological purposes both for activation of defects gettering processes and for decrease of semiconductor structures thermodynamic nonequilibrium degree. Therefore, microwave radiation influence effects in semiconductor devices, and their activating mechanisms are of interest of great amount of specialists. Moreover, microwave radiation can be used for selective heating of metallic conducting covers on semiconductor device structures. This method can be universal technological process due to selection of main frequency of microwave radiation, pulse duration and radiation power. Researched object is of interest due to fact that molybdenum does not attract to GaAs in wide range of thermal treatment (up to 800 K), but under thermal influence it spreads into GaAs, hence, expected modification of Schottky barriers parameters must be related to modification of transition layer thickness at boundary Mo–GaAs due to mass carry of Mo atoms, lightened by presence of real surface. Therefore, stimulated by microwave radiation mass carry of molybdenum atoms must modify parameters of transition layer at a boundary Mo–GaAs. In paper [8] they described detected further mass carry in contacts Pt–As, stimulated by microwave radiation, at that they observed formation of compound of Pt with As. Mo–GaAs contacts from this viewpoint are more suitable model objects for research of real transition area in Mo–GaAs contacts and influence of microwave radiation on Schottky barrier parameters.

In this paper we consider an influence of microwave radiation on transition layer properties on a boundary Mo–GaAs and this contact parameters, using example of diode with Schottky barrier Mo–n–n^+–GaAs.

EXPERIMENTAL METHODOLOGY

Diode structures Mo–n–n^+–GaAs are created by means of molybdenum electron-beam sputtering on n–n^+–GaAs structure. Concentration of dopant (Te) in n-film was 2×10^{16} cm^{-3}, the layer thickness was about 3 μm, concentration of dopant (Te) in n^+-layer was 2×10^{18} cm^{-3}, substrate thickness was 350 μm. Schottky barrier diameter was 300 μm. Ohmic contacts were created on a basis of AuGe eutectic. Microwave radiation source was a magnetron with f = 2.45 GHz and output power 800 W. We research concentration profiles of components distribution on contacts of tested structures before and after microwave treatment during 5 seconds by means of Auger spectroscopy, using profilometer–profilograph