The effects of the interfacial layer with interface states on controlling the electronic properties of Au/n-GaAs Schottky diode

By: Soylu, M (Soylu, Murat)[2] ; Cavas, M (Cavas, M.)[3] ; Al-Ghamdi, AA (Al-Ghamdi, A. A.)[4] ; Al-Hartomy, OA (Al-Hartomy, Omar A.)[4,5] ; El-Tantawy, F (El-Tantawy, Farid)[6] ; Yakuphanoglu, F (Yakuphanoglu, F.)[1]

View ResearcherID and ORCID

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Abstract

The electrical characteristics and interface state density properties of Au/insulator/n-GaAs (MIS metal-insulator semiconductor) diodes with insulator layers having different thickness have been analyzed by current-voltage and capacitance-voltage techniques at room temperature. The barrier height and ideality factor values for MIS Schottky diodes were found to be 0.66 eV, 1.67 and 0.86 eV, 3.75, respectively. The diodes show a non-ideal I-V behavior with the ideality factor greater than unity. This behavior is attributed to the interfacial insulator layer and the interface states. The obtained results show that the insulator layer modifies the electrical parameters such as interface state density, series resistance and reduces the reverse bias leakage current by more than two orders of magnitude. In addition, the interface distribution profiles (D-it) were extracted from the I-V measurements by taking into account the bias dependence of the effective barrier height for the Schottky diode. The energy distribution curves of the interface states of each sample were determined. The interface state density N-ss of the diodes was changed from 4.7x10(12) eV(-1) cm(-2) in (Ec-0.647) eV to 6.35x10(14) eV(-1) cm(-2) in (Ec-0.619) eV for the initial sample AuD1 MIS diode and from 2.67x10(15) eV(-1) cm(-2) in (Ec-0.850) eV to 1.01x10(15) eV(-1) cm(-2) in (Ec-0.756) eV for AuD2 MIS diode.

Keywords

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Author Information

Reprint Address: Yakuphanoglu, F (reprint author)

+ Firat Univ, Fac Sci, Dept Phys, TR-23169 Elazig, Turkey.

Addresses:

+ [1] Firat Univ, Fac Sci, Dept Phys, TR-23169 Elazig, Turkey
+ [2] Bingol Univ, Fac Sci, Dept Phys, Bingol, Turkey
+ [3] Firat Univ, Maden Higher Vocat Sch, TR-23169 Elazig, Turkey
+ [4] King Abdulaziz Univ, Fac Sci, Dept Phys, Jeddah, Saudi Arabia

[5] Tabuk Univ, Fac Sci, Dept Phys, Tabuk 71491, Saudi Arabia

+ [6] Suez Canal Univ, Fac Sci, Dept Phys, Ismailia, Egypt

E-mail Addresses: fyhanoglu@firat.edu.tr

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