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GaAs 표면 보호막 및 계면 제어를 통한 Schottky 접합특성 향상 연구

Improvement of GaAs Schottky contact by surface passivation and effective interfacial cleaning

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We developed a new method for accomplishing an ultimate improvement on Au/GaAs Schottky contact, which has been made with a complete elimination of defective interfacial compounds. In this study, the realistic interfacial bonding states was clarified with a nondestructive interface-characterization by x-ray photoelectron spectroscopy. Schottky contact of conventionally $(NH_4)_2S$-passivaed GaAs showed a better contact property than unpassivated GaAs due to the complete excluding of interface oxide, but its interface still included a defective excess As. This interfacial excess As was originated from the interfacial reaction during Au deposition, that is, the bonding transition of As sulfide into Ga sulfide. This interfacial by-product was effectively controlled by hydrogen plasma treatment of Au-coated GaAs, varying the thicknesss of Au and plasma condition and the mechanism of interfacial cleaning was understood In optimized condition, the hydrogenation of their interfaces removed effectively defective interfacial bonds, especially As-related compounds, and in particular, had no damage into GaAs substrate The most improved GaAs Schottky diode could be realized by a combination of sulfidation of GaAs surface and carefully controlled hydrogenation of the interface, and its leakage current density was reduced about ten times as low as a conventionally S-passivated GaAs Schottky diode. Finally, real interface state density of them was evaluated by photoluminescence and the result was in a good accord with the electrical characteristics and the interfacial feature of Schottky contact