

Surface study of AlGaAs/GaAs structure after ammonium sulphide (NH₄)₂S chemical passivation

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GaAs and AlGaAs are both widely used materials in the world of electronics and optoelectronics, but their good properties are clouded by their high surface recombination rate, caused by the formation of an oxide layer and surface states [1]. Surface passivation is an essential step to avoid/limit surface oxidation and thus reduce the surface recombination [2]. In this study, we focused on the specific case of chemical passivation with ammonium sulphide ((NH₄)₂S) applied to GaAs and AlGaAs surfaces.

GaAs and Al_{0.3}GaAs surfaces grown on GaAs (100) were chemically treated with (NH₄)₂S solution, and were submitted to different experiments: temperature dependant ellipsometric measurements, RHEED observation, XPS. GaAs-based MIS capacitors were then processed and the frequency dependence of C(V) analysed.

Figure 1 shows the C(V) curves obtained at different frequencies and for different treatments. Fig. 1a shows a non-passivated sample which is strongly oxidised (q.v. inset). Fig. 1b shows a passivated sample with (NH₄)₂S. Passivation is visible in the inset with the presence of arsenic-sulphur bond. Density of interface trap (Dit) values are extracted from the C(V) curves. The value of Dit is an indicator of the efficiency of the passivation. For the passivated sample, Dit values are of the order of 10¹¹ ev⁻¹.cm⁻² throughout the bandgap, except at the vicinity of the conduction band, where the values are of the order of 2x10¹² ev⁻¹.cm⁻². Dit values obtained are comparable to other passivation methods describes in literature [3], demonstrating good efficiency of our chemical passivation.

Bibliography :

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