Electrodeposition of gold on (111) and ($\bar{1}\,\bar{1}\,\bar{1}$) n-GaAs

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The formation of semiconductor/metal interfaces by electrodeposition is a valuable alternative for the generally used dry methods under vacuum conditions (e.g. metal evaporation or sputtering), because it is a simple and low-cost technique. Furthermore, it has been shown that the characteristics of semiconductor/metal interfaces formed by wet deposition are comparable to and in some cases better than those formed by dry methods [1,2].

Recent research carried out in our group revealed that the electrochemical formation and the properties of (100) n-GaAs/Au contacts depend strongly on the surface composition of the semiconductor before deposition [3].

In order to gain more insight in the role of the surface composition in the electrodeposition process, the research on the formation of n-GaAs/Au contacts was extended to two other surface orientations, namely the (111) and ($\bar{1}\,\bar{1}\,\bar{1}$) plane.

The electrochemical reduction of $Au(CN)_2^-$ on n-GaAs (111) and ($\bar{1}\,\bar{1}\,\bar{1}$) was investigated by rotating-disk and cyclic voltammetry. Nucleation of Au on the semiconductor was studied by analysing current-time transients in the initial stage of the deposition and by ex-situ SEM of the surface after a short deposition time. The electrical properties of the n-GaAs/Au barrier were determined by means of current density vs. potential measurements of the dry junction.

The results obtained at the (111) and ($\bar{1}\,\bar{1}\,\bar{1}$) n-GaAs were compared both mutually and with the results obtained at (100) n-GaAs [3]. The observed differences in electrochemical behavior of and nucleation mechanism at the three semiconductor orientations are explained by a different surface composition.

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