# Field and Thermionic-Field Transport at GaAs/AlGaAs/GaAs Heterojunction Barriers

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This paper considers a simplified model of the transport of electrons by tunnelling within a GaAs/AlGaAs/GsAs heterojunction (1,2). The model is applied specifically to tunnelling through a triangular barrier formed by the compositional grading of the $Al_x Ga_{1-x} As$ region from $x = 0$ to $x = 0.3$, but can in principle be extended to a range of barriers geometries encountered at heterojunction or metal/semiconductor interface. The experimental data for the current-voltage characteristics obtained for a range of temperatures from 77K to 273K are used to test the functional dependence obtained from calculations. Good agreement has been obtained between theory and experiment, thus confirming the usefulness of the simple model for device evaluation. The comparison of data over the temperature range shows that the thermionic-field emission observed at 273K gives way to field emissions of 77K. This is a result of the retrieval of the more energetic electrons in the conduction band at lower temperatures. The proposed model is less cumbersome than the extensive analysis of Padovani and Stratton (3) and this provides a relatively simple analytical tool to understand the electronic transport through barriers in the conduction band of heterojunction devices. This is a useful tool for researchers working in the field of transport in heterostructures.

The results used with this simplified model are compared in detail with comparable numerical simulations obtained.

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(2) Morgan D.V., Porch A & Krishna R, Physica Status Solidi (in press, 2006)

(3) Padovani F, A., & Stratton R. Solid State Electronics 9 pp 695-707 (1966).