14:00-14:15 **[13]**

Drift-Diffusion Type Device Simulator Including Carrier Temperature Model

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A novel carrier temperature model is proposed for the drift-diffusion type device simulator. The characterization of MOSFETs down to the deep sub-micron has been obtained as fast as the conventional device simulator.

We used the fourth moment equation of the Boltzmann transport equations to determine the carrier energy. An alternative energy transport equation incorporating the energy flux is

$$\nabla S = J\cdot E - n\cdot B \ .$$

Where B is the energy-dissipation factor. The carrier temperature is defined because the term of the energy flux is possible to be neglected as a first approximation.

We applied these models to the n-channel LDD MOSFET having 0.5μm gate length, 0.25μm side wall spacer and 15nm gate oxide thickness.
Simulation results agreed well with the measured data as shown in Fig 1. It has become clear that the electron temperature is greater than 2700 K near the drain as shown in Fig.2. The electron density distribution for the present and the conventional models are shown in Fig.3-1 and Fig.3-2, respectively. It is clear that the electron density distribution spreads for the present model. The channel thickness by the present model is about twice deeper than that of the conventional model.

We have proposed and formulated the novel carrier temperature model for the drift-diffusion type device simulator. The CPU time is about twice of the conventional program. This modeling is available for the analysis of the deep sub-micron devices.

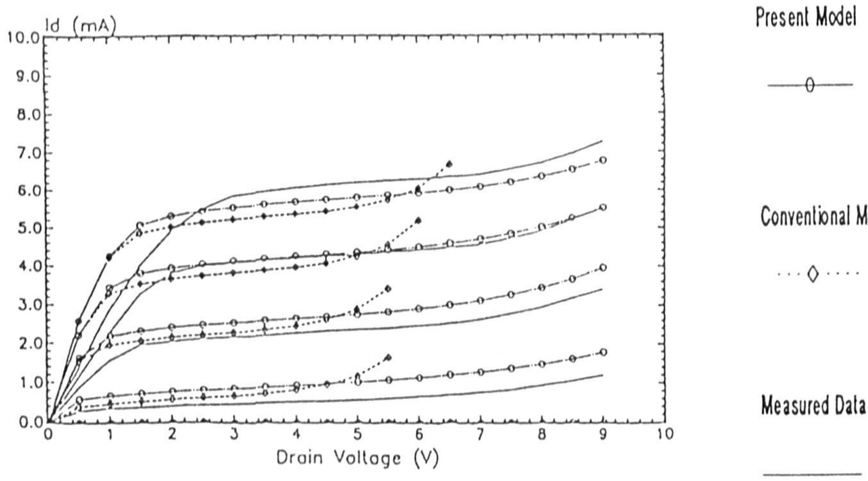

Fig.1 Id-Vd characteristics

(Vb=-3V, Vg=0,1,2,3,4V)

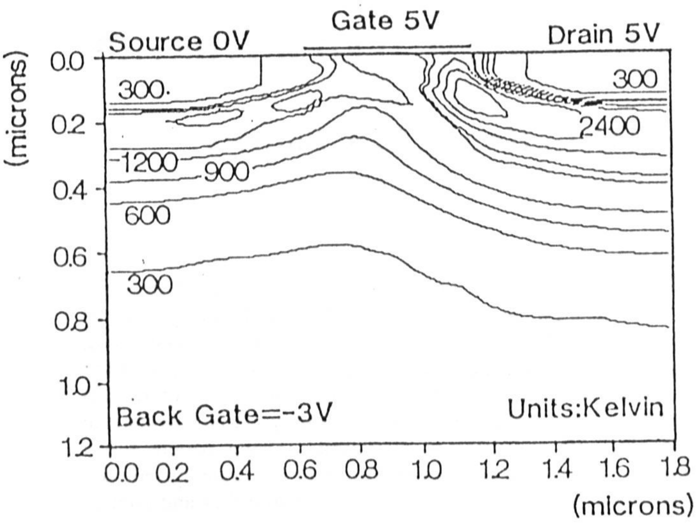

Fig.2 Electron temperature distribution

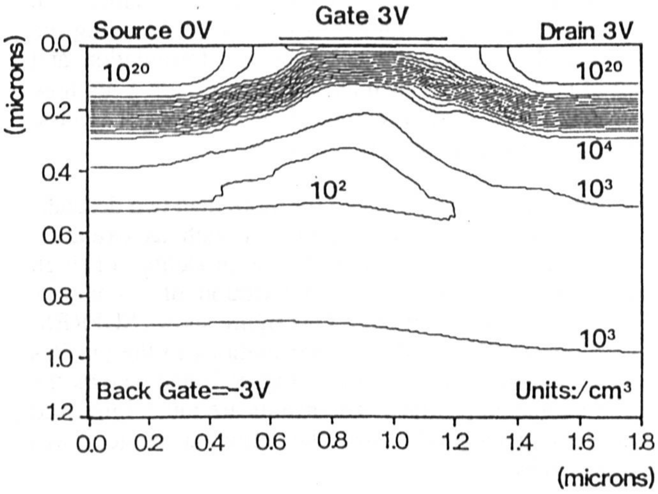

Fig.3-1 Electron density distribution
(present model)

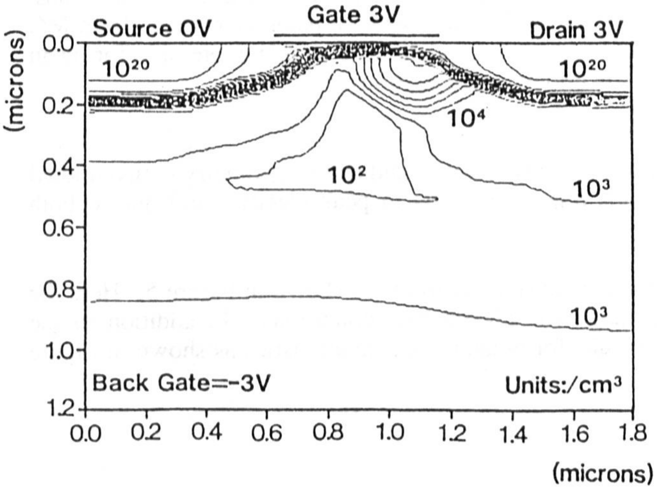

Fig.3-2 Electron density distribution
(conventional model)