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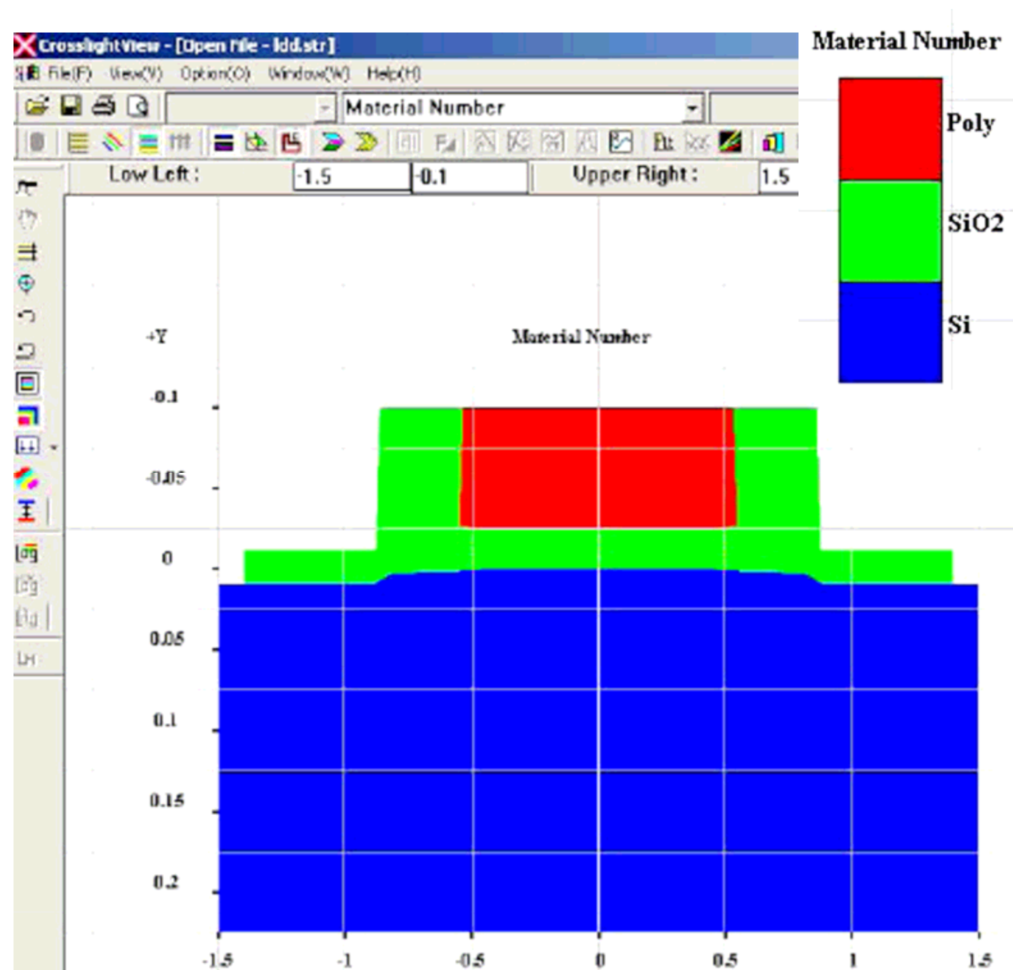
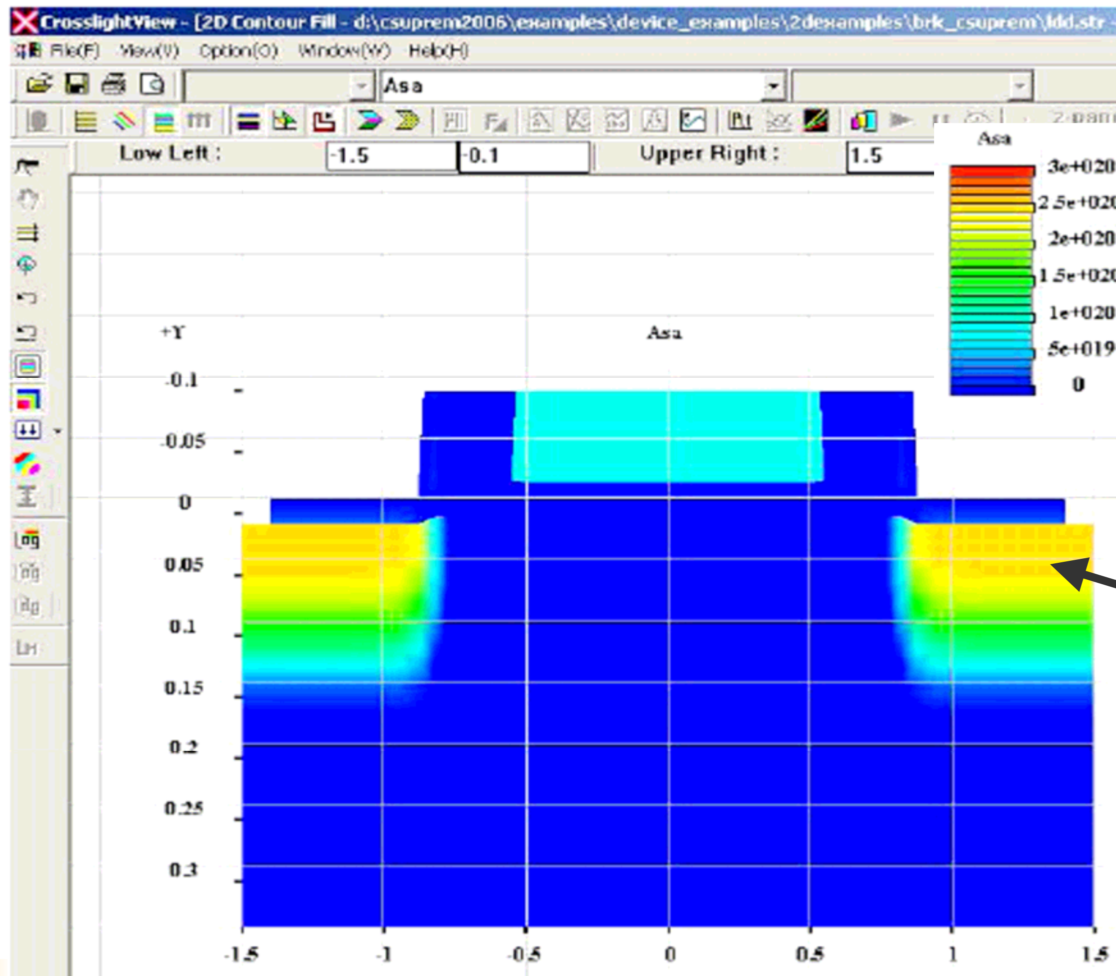
CSuprem Process Modeling



- **Processed device structure.**

Arsenic Implantation & Diffusion



- n^+ source & drain region formed by arsenic implantation & diffusion.

n^+ drain

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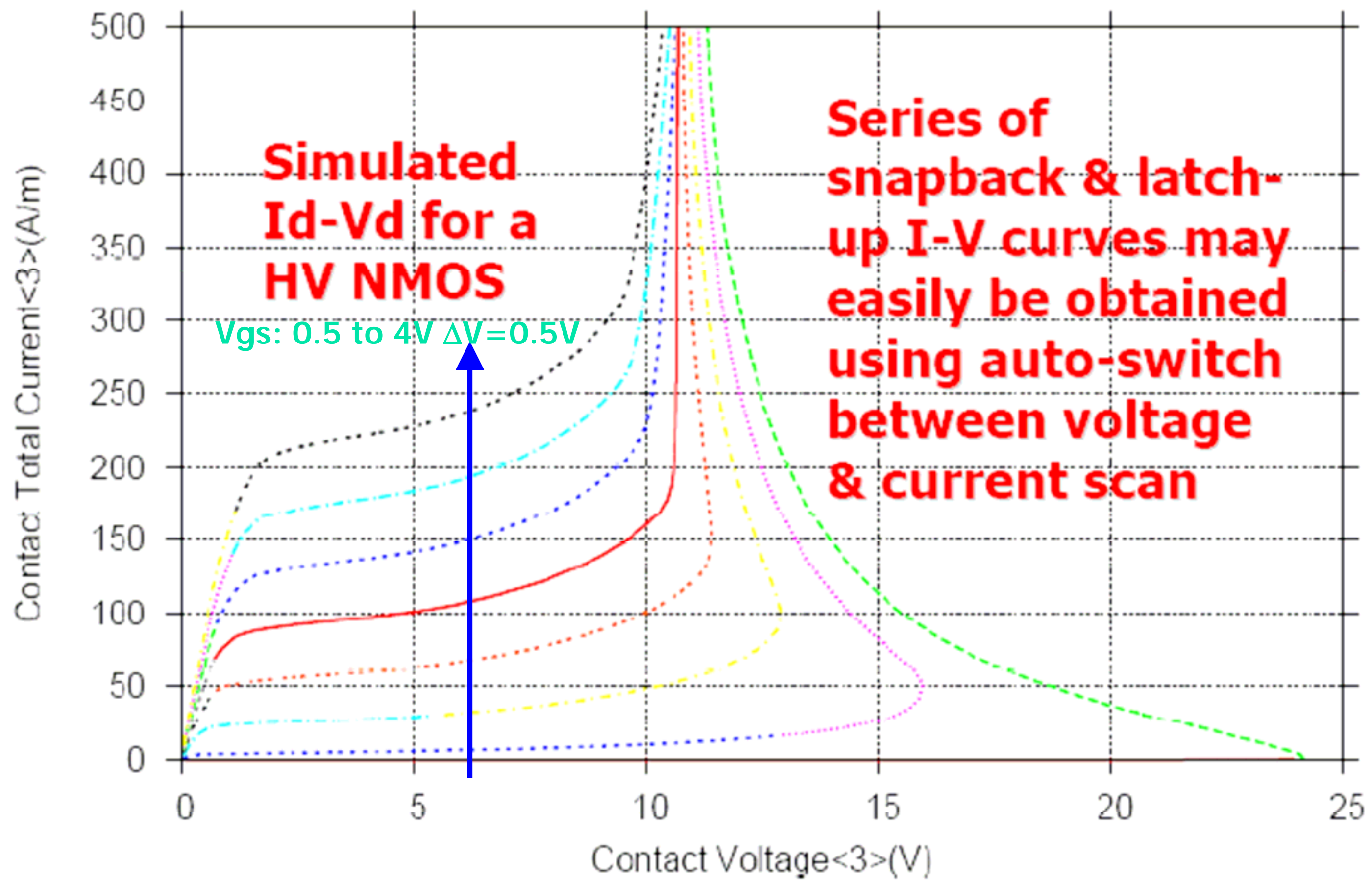
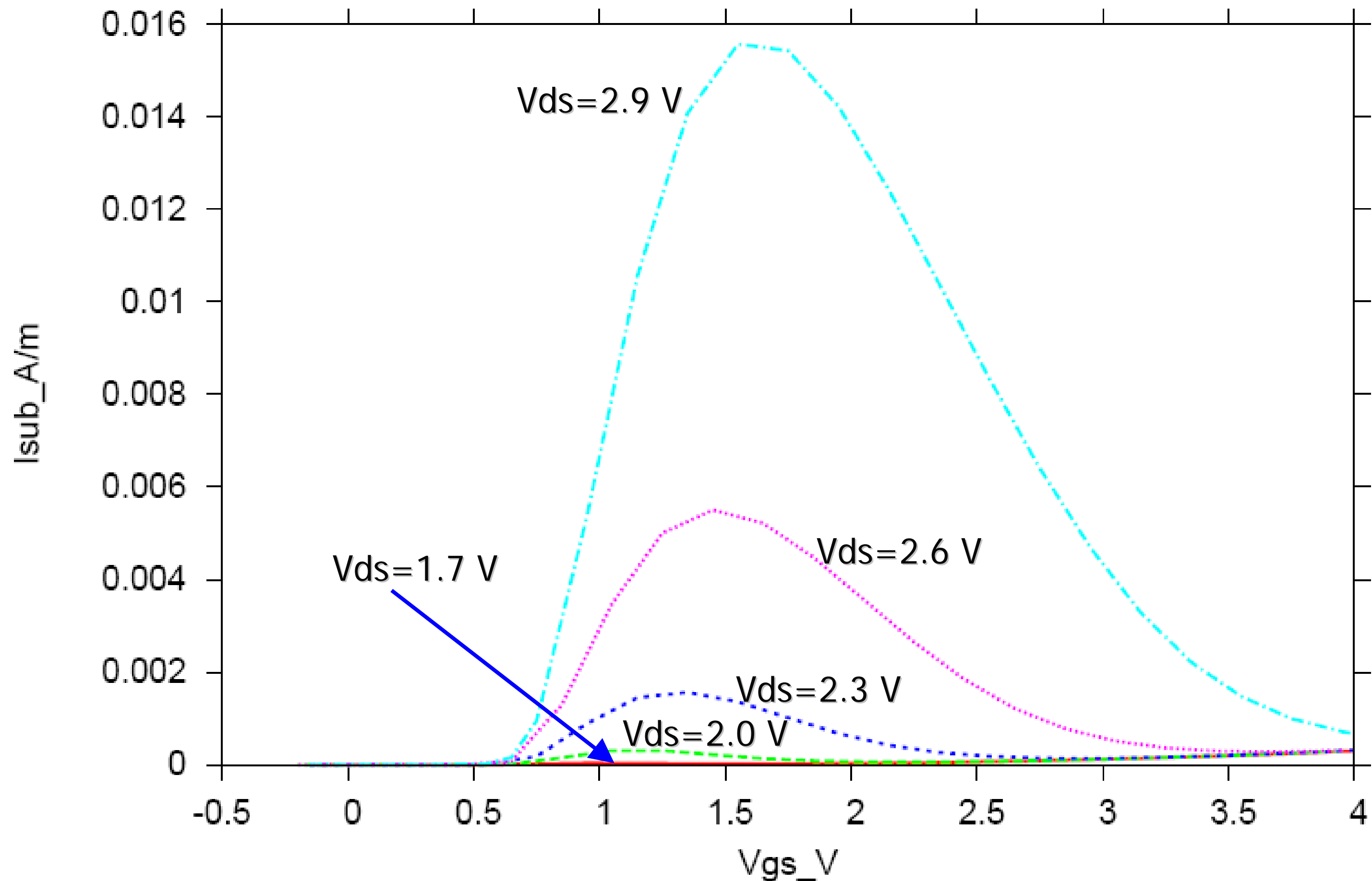
Ids vs Vds



- **Ids-Vds curves with various Vgs from 0.5 V (bottom curve) to 4 V (top curve).**

Isub vs Vgs (a)



- **The characteristic bell-shaped curves give clear indication of impact ionization origin for I_sub.**

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Bell-shaped Isub - Experimental

K.G. Anil et al. / Solid-State Electronics 47 (2003) 995–1001

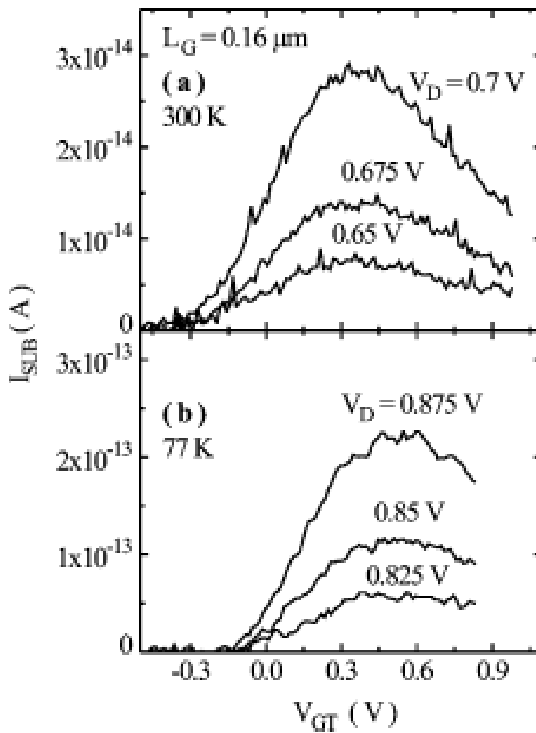
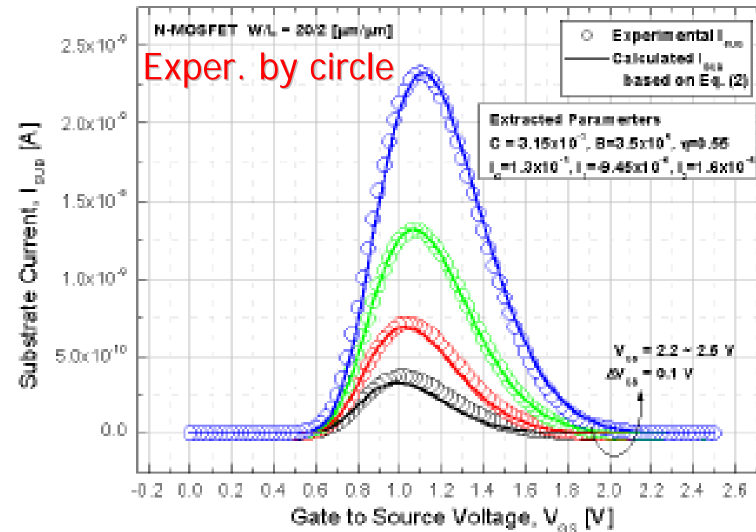


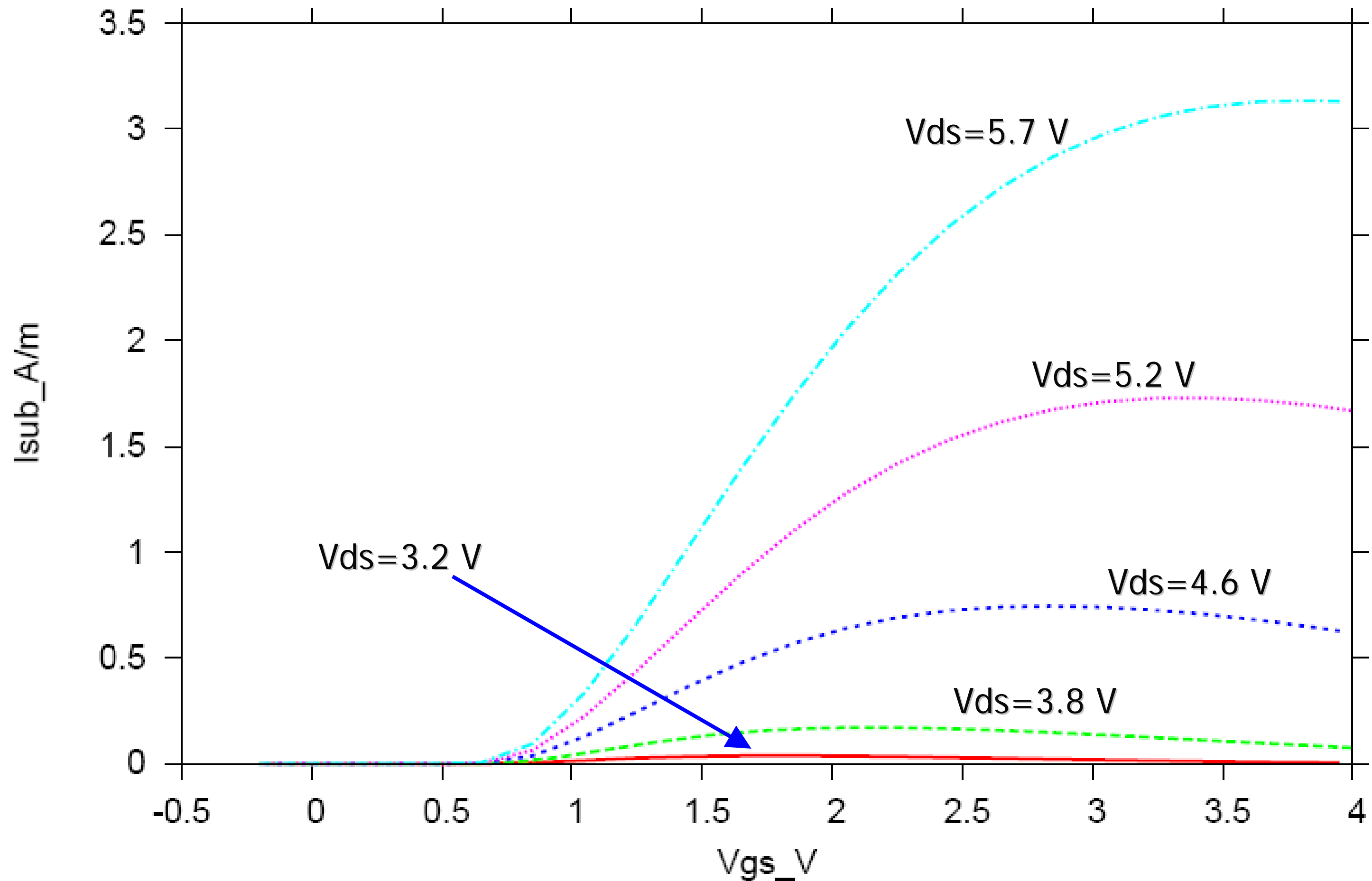
Fig. 1. Measured I_{SUB} versus V_D plots for $L_G = 0.16\ \mu m$ at (a) 300 K and (b) 77 K. $V_{GT} = V_G - V_T$, where V_T is the threshold voltage.



IC Nam et al,J. Korea Phys Soc.V45N5(2004)1283-1287

- **Competing factors: Ids increases as Vgs increases, but increased Vgs also brings the channel from depletion into inversion, which decreases the lateral electric field in the pinch-off region & suppresses impact ionization.**
- **The maximum Isub occurs when the two factors balance.**

Isub vs Vgs (b)



- **The bell shape disappears at high Vds with enlarged pinch-off region & Ids tends to saturate due to reduced channel length.**

Summary

- N-channel MOSEFET successfully processed by CSuprem modeling.
- Device modeling carried out by APSYS with CSuprem import.
- Bell-shaped substrate current curves are successfully demonstrated and are consistent with experimental data.