Hints, Tips and Solutions

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Q. How to obtain a stable grid and smooth doping profile in non-planar a-Si TFT using *ATHENA/Elite*?

A. Silvaco process and device simulation tools have been successfully used for many TFT applications. It has been shown that if accurate density of state distributions are specified the transfer characteristics of TFT devices show good agreement with experiments. The typical configuration of TFT includes a non-planar n+ doping source/drain region around the metal gate. Such a non-planar structure could be simulated only by the process simulator ***ATHENA*** because ***ATLAS*** cannot generate the regions with rounded shapes.

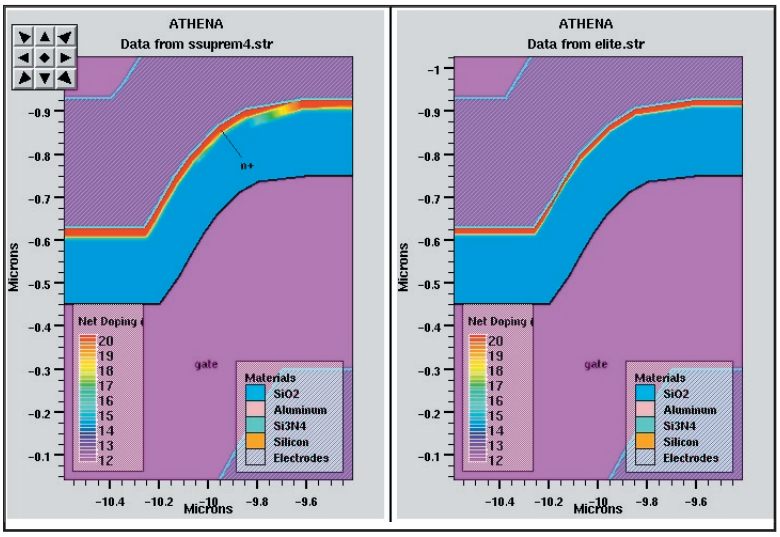

Figure 1. Ssuprem4 n+ doping v.s Elite doping profile

The accuracy of ***ATLAS*** device simulation strongly depends on grid quality and uniformity of doping along the surface of a-Si region. The internal ***SSuprem4*** deposition algorithm does not produce a smooth grid and consequently uniform doping. To overcome this difficulty the advanced topography simulation module of ***ATHENA*** must be used for a-Si deposition step. ***Elite*** produces much better grid and avoids non-uniform doping as seen in the left plot of Figure 1.

Figure 2 shows that experimentally proved IV-curves can only be obtained when ***Elite*** module is used for simulation of the critical a-Si deposition step. If ***Elite*** is not used the reverse biased trend of the IV-curve disappears which means that these characteristics are very sensitive to the grid and doping quality. Therefore, we strongly recommend to use ***Elite*** deposition for simulation of non-planar TFT devices.

Call for Questions

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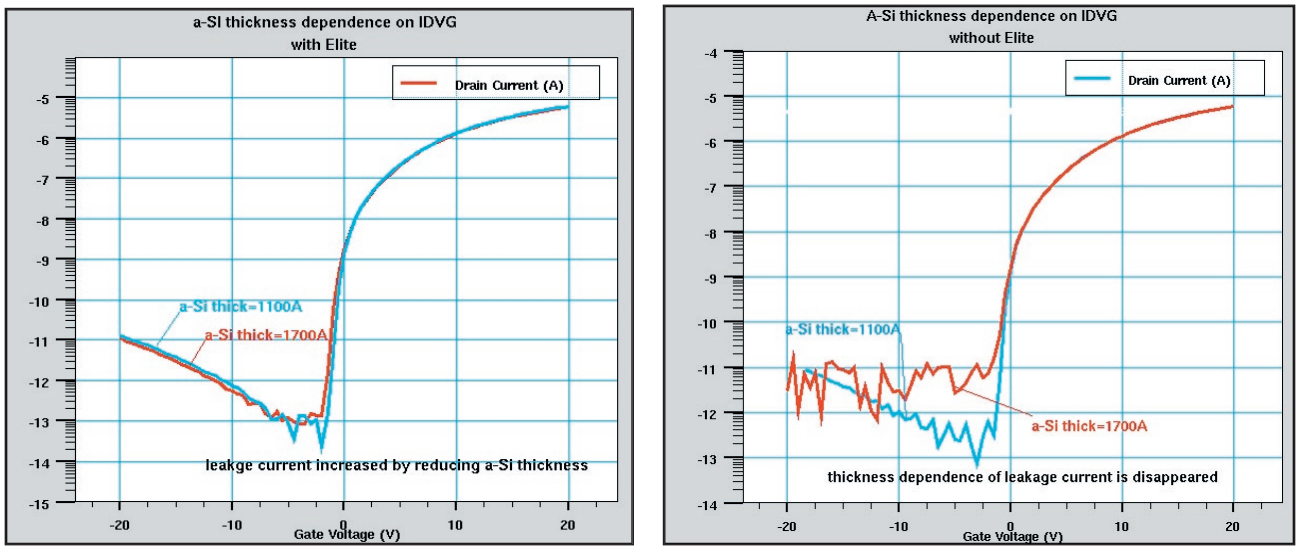

Figure 2.(experimental data is omitted) The left plot shows leakage current increase with a-Si thickness when simulating with ELITE. The right plot does not show such a behavior if ELITE is not used.