Introducing Physics Models

In

CSuprem

CROSSLIGHT
Software Inc.

Csuprem Overview

- State-of-the art 1D, 2D and 3D process simulator of various semiconductor structures based on advanced physical models for ion implantation, deposition, etching, diffusion, and oxidation.
- Reliable and accurate simulation tool indispensable for controlling the explosive cost of IC fabrication steps.
- Export doping profiles needed in device simulations.
- Based on technology licensed from Stanford University (Prof. Robert Dutton's group).

Ion Implantation

- Physical models:

Gauss and Pearson IV distribution.

- Available impurities:

antimony, arsenic, boron, bf2, cesium, phosphorus, beryllium, magnesium, selenium, isilicon, tin, germanium, zinc, carbon, generic.

- Damage models:

The damage due to the implant can be calculated for antimony, arsenic, boron, and phosphorus.

- Low energy implant:

Low energy implant is now available for all dopants.

Deposition

- Supported materials:

  Silicon, oxide,oxynitride, nitride, polysilicon, photoresist, aluminium, gallium-arsenide.

- Doping types:

  none, antimony, arsenic, boron, phosphorus, beryllium, magnesium, selenium, isilicon, tin, germanium, zinc, carbon, generic.

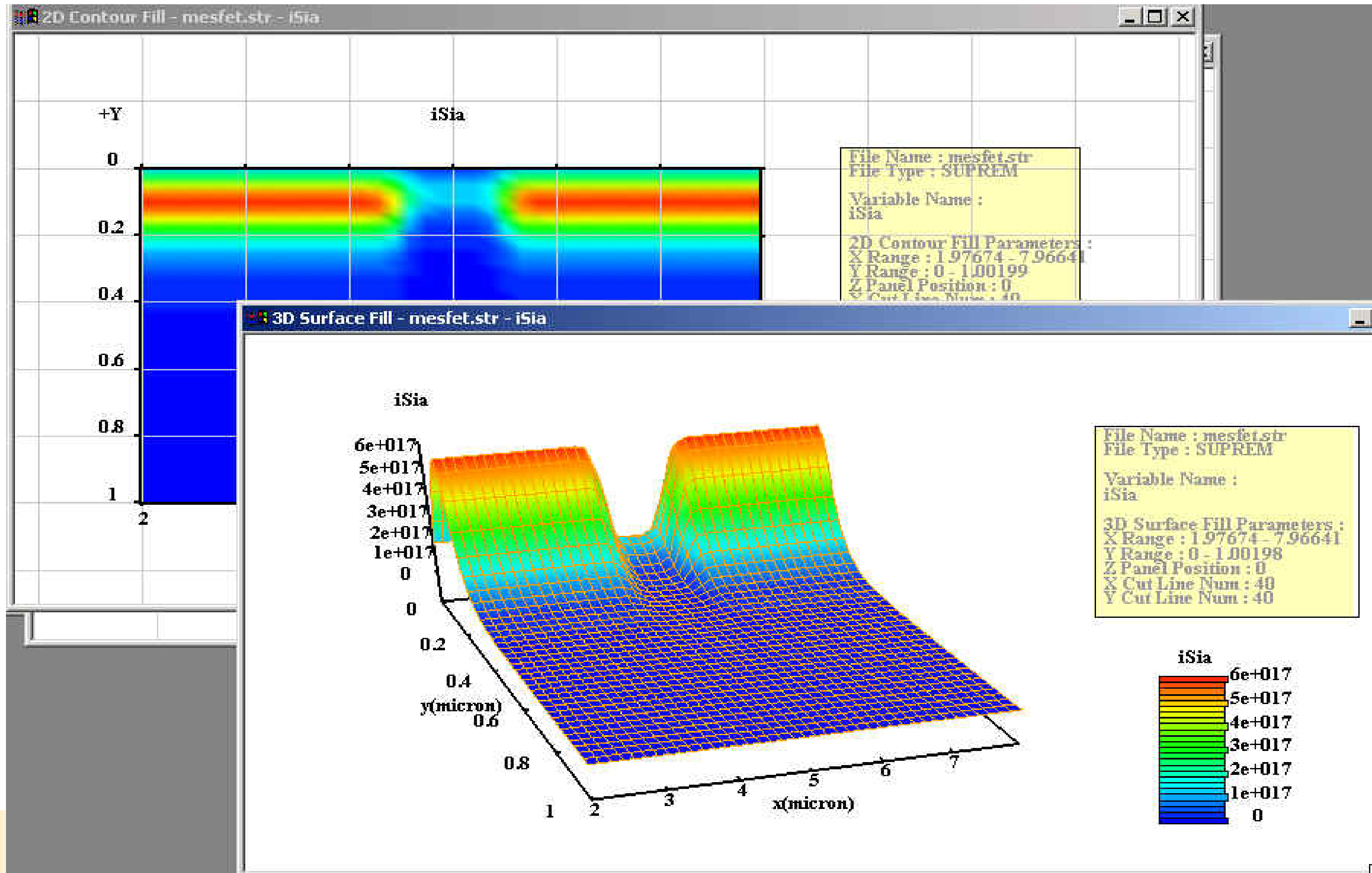
- Import file:

  The user can also supply an input file containing the coordinates associated with the deposit surface. This file could be generated by a topography simulator.

Diffusion

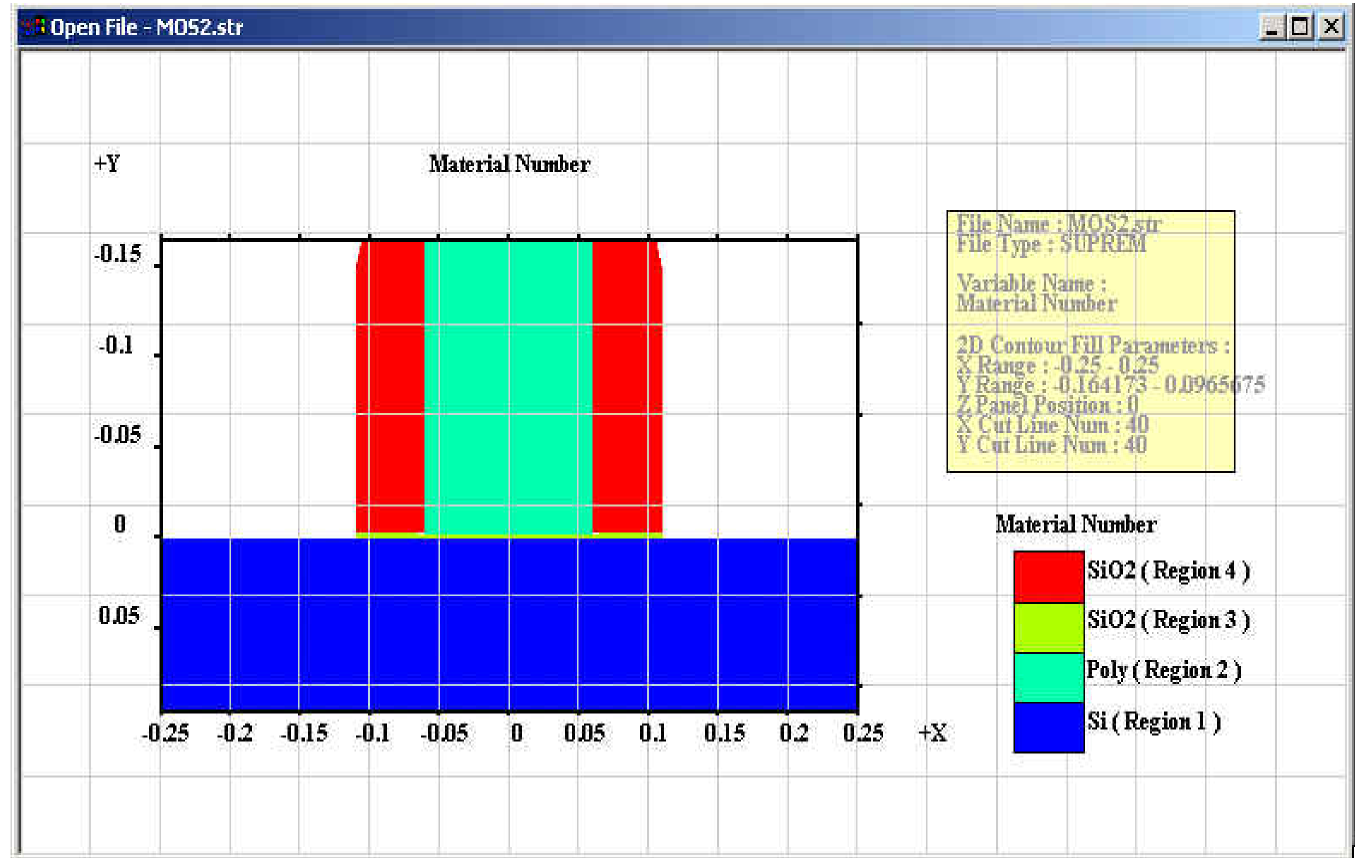
- Point-defect based diffusion models
- Paired and unpaired diffusion of point defects models
- Transient enhanced diffusion (TED) for damage and clustering
- Oxidation enhanced diffusion (OED)
- Oxidation retarded diffusion (ORD)
- Interface segregation models
- Dislocation loops model

GaAs MESFET



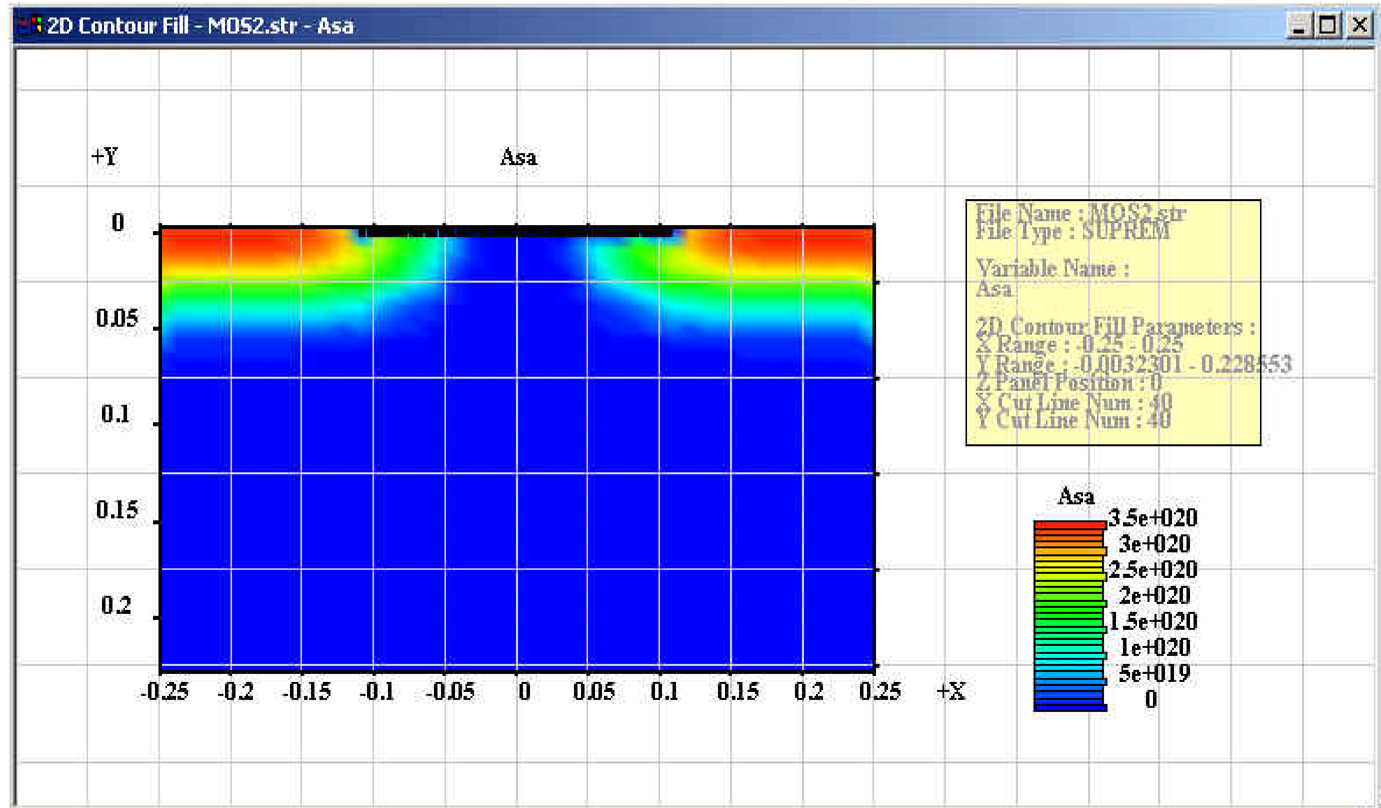
Ultra-thin-Oxide MOSFET

Complete steps for processing ultra-thin-oxide (1.3nm) MOSFET



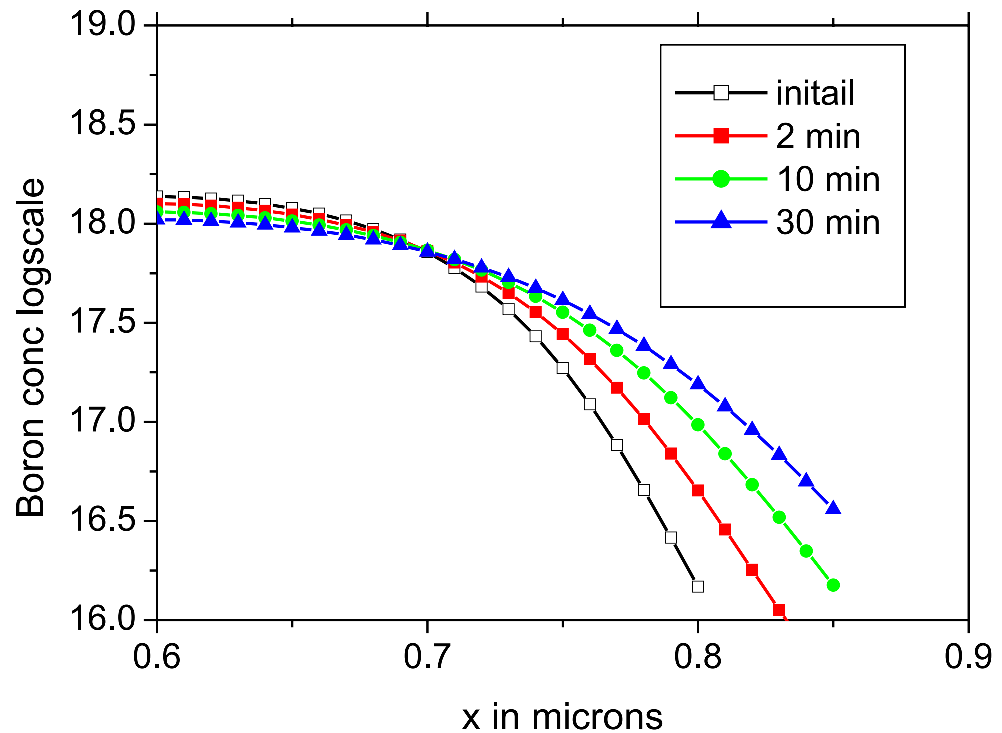
Shallow junctions

Doping profiles may be exported for device Simulator APSYS



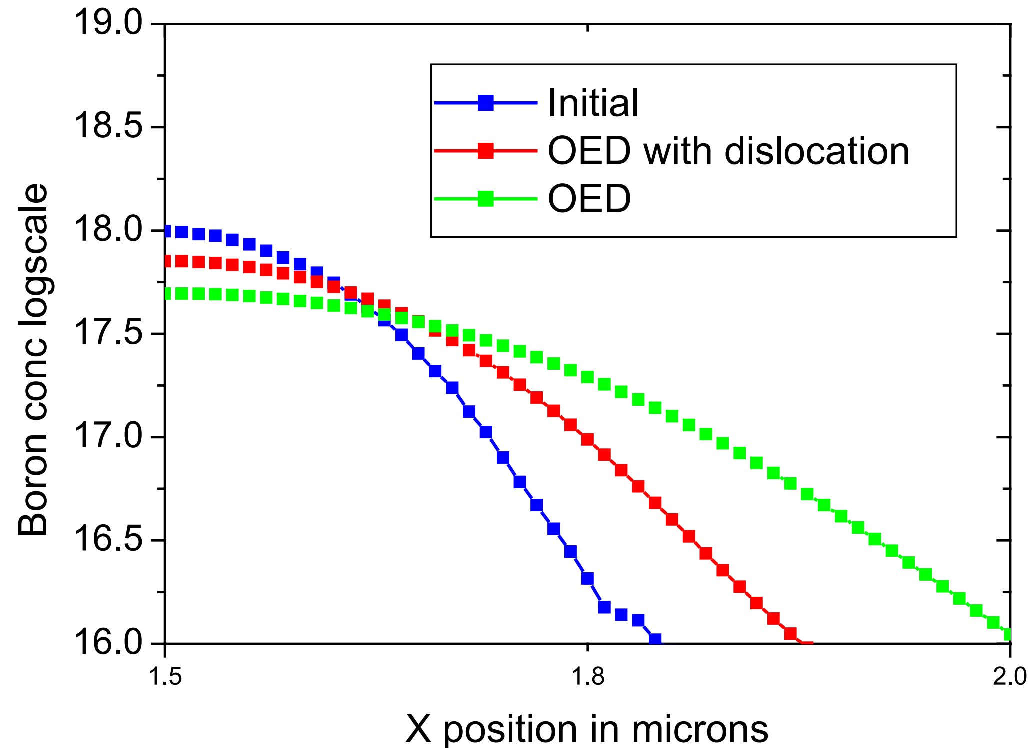
Advanced Diffusion model-I

Interstitial cluster dissolution effect on boron diffusion

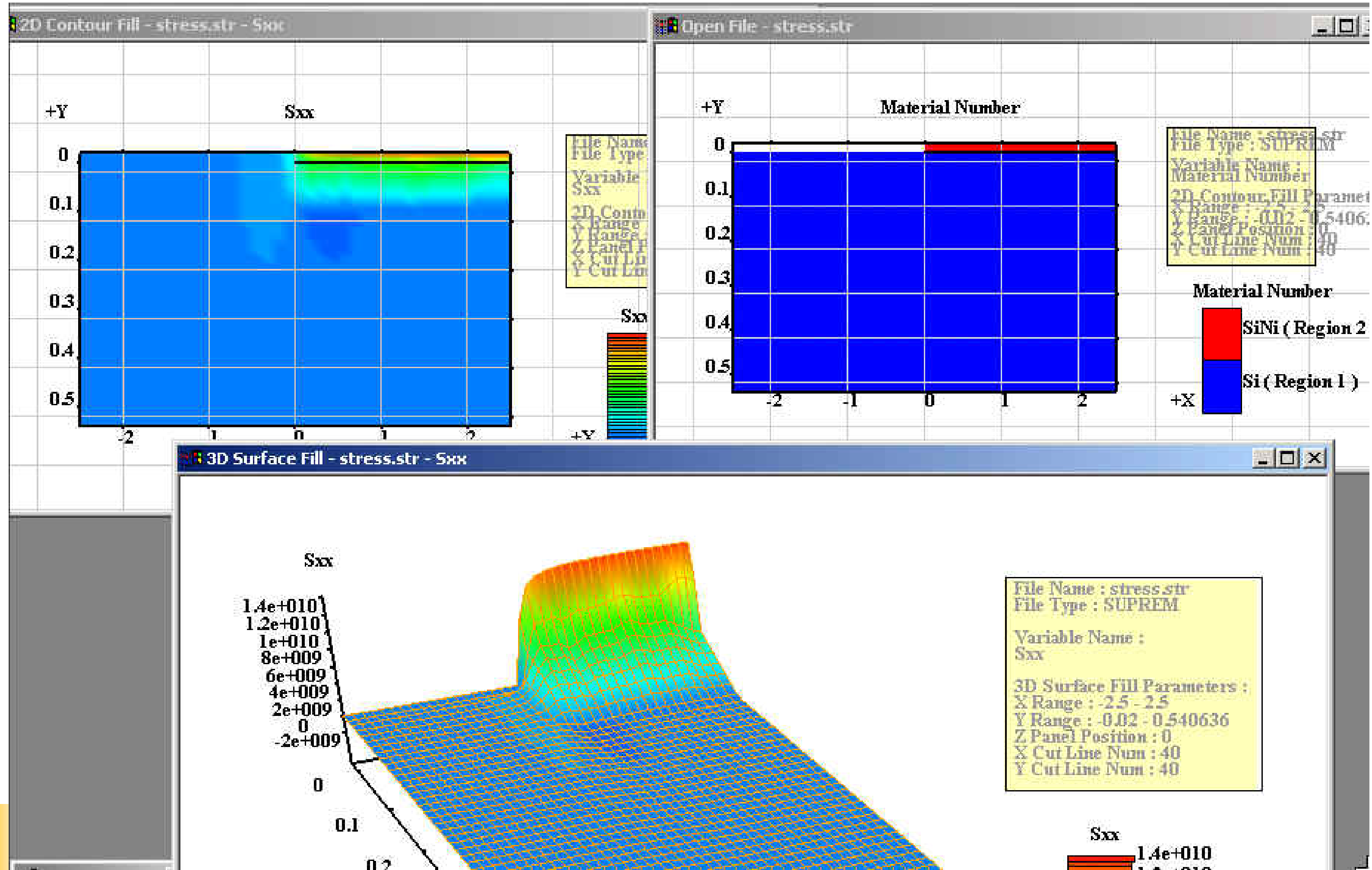


Advanced Diffusion model-II

Diffusion in presence of dislocation loops



Stress induced by Si_3N_4-I



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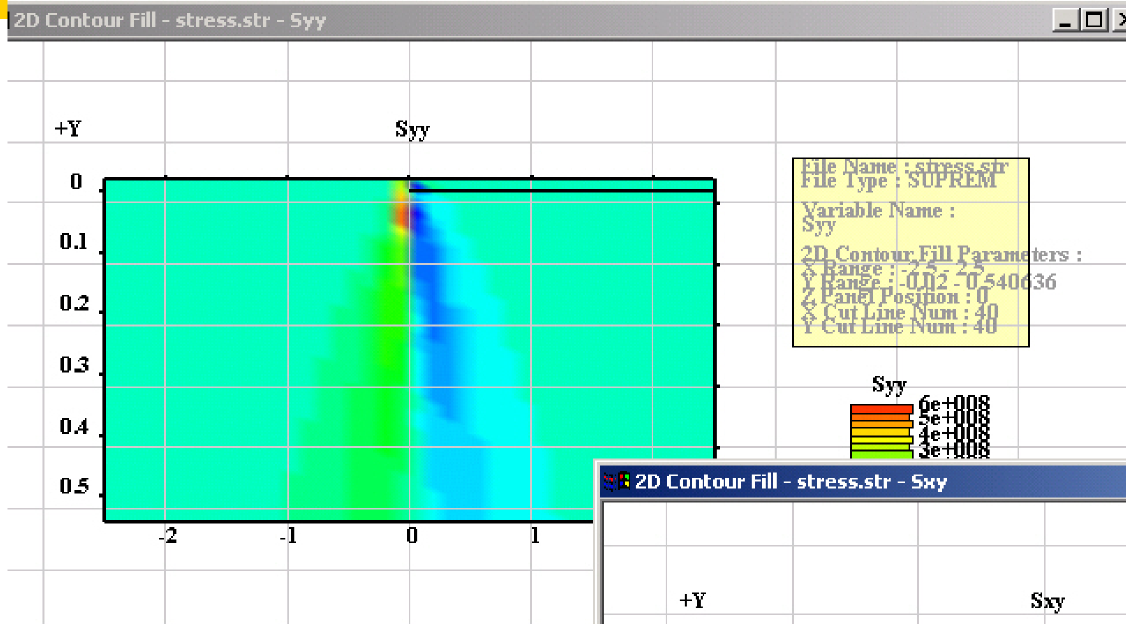
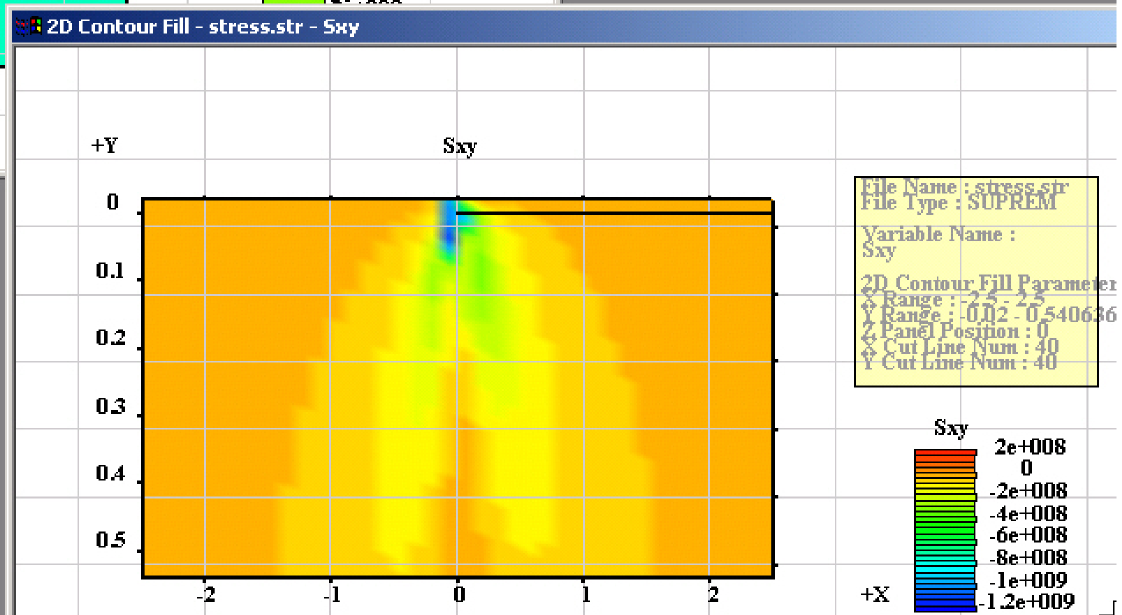
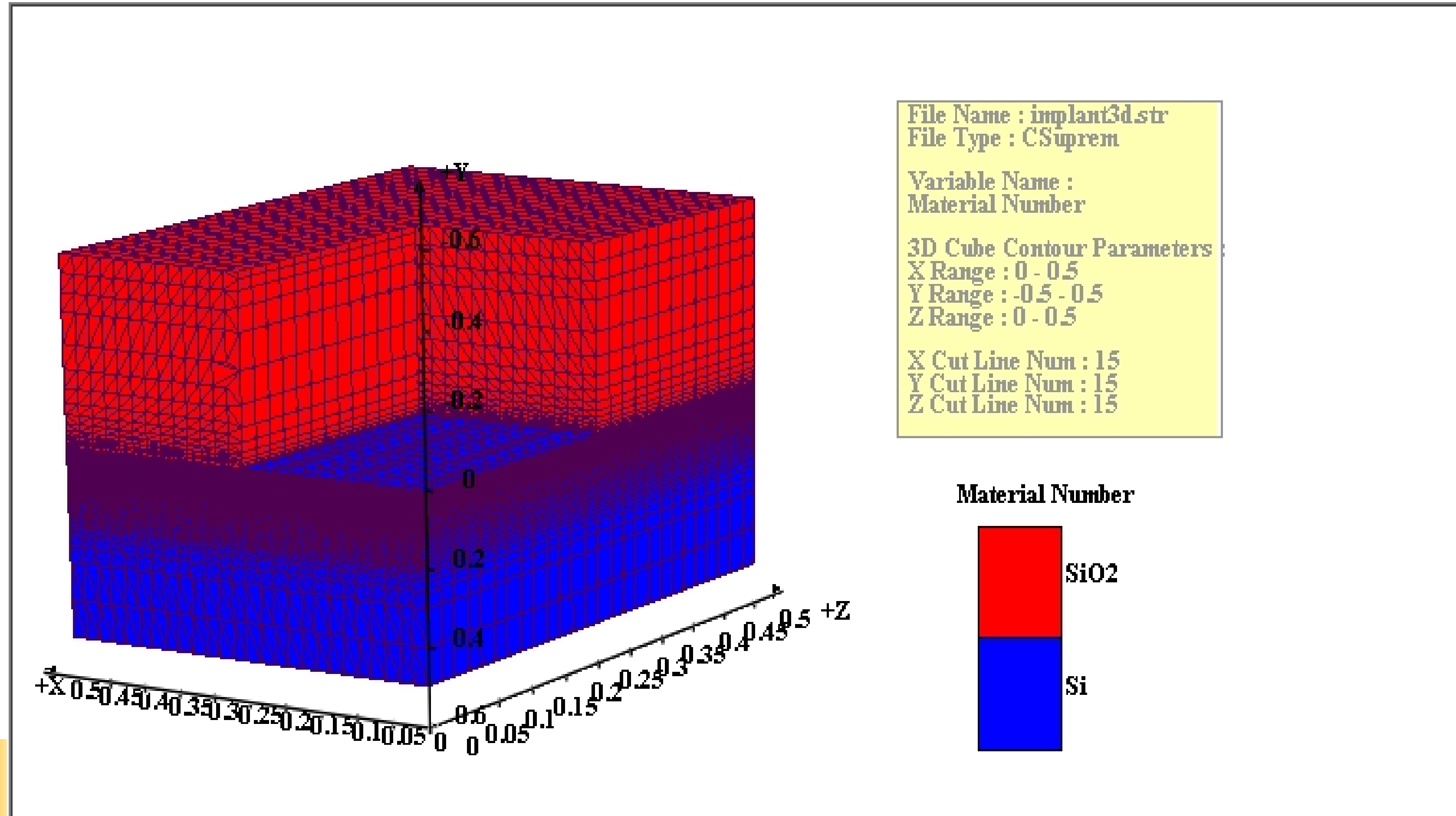
Stress induced by Si_3N_4-I

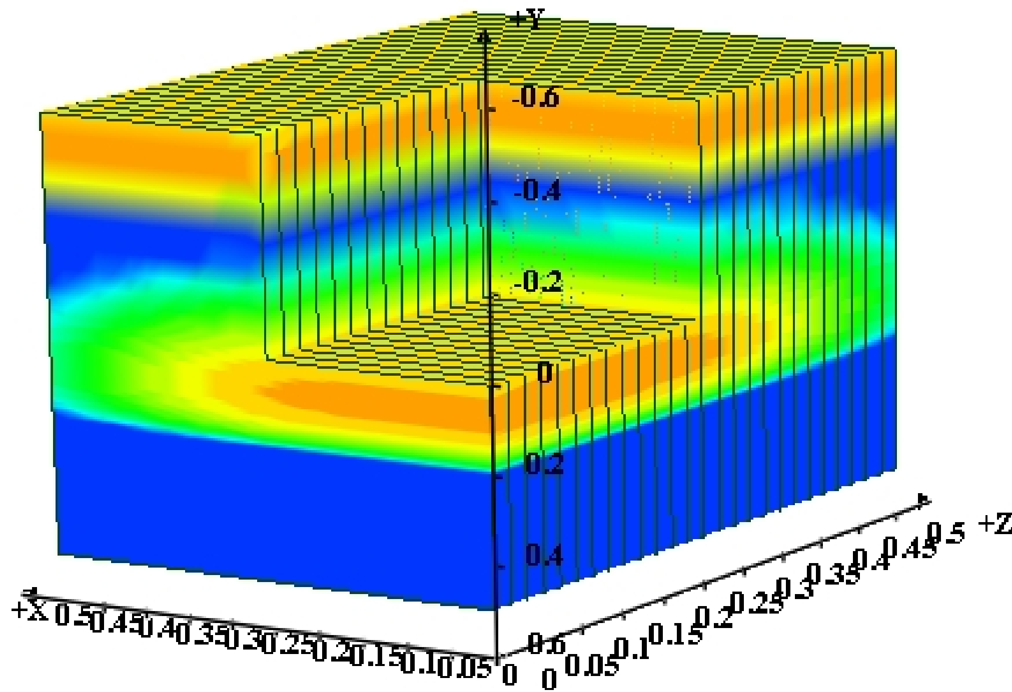




3D mask structure with mesh



3D mask effects on Boron implant

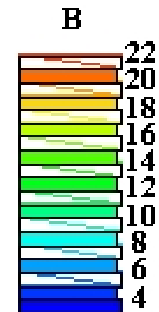


File Name : implant3d.str
File Type : CSuprem

Variable Name :
B

3D Cube Contour Parameters :
X Range : 0 - 0.5
Y Range : -0.5 - 0.5
Z Range : 0 - 0.5

X Cut Line Num : 15
Y Cut Line Num : 15
Z Cut Line Num : 15



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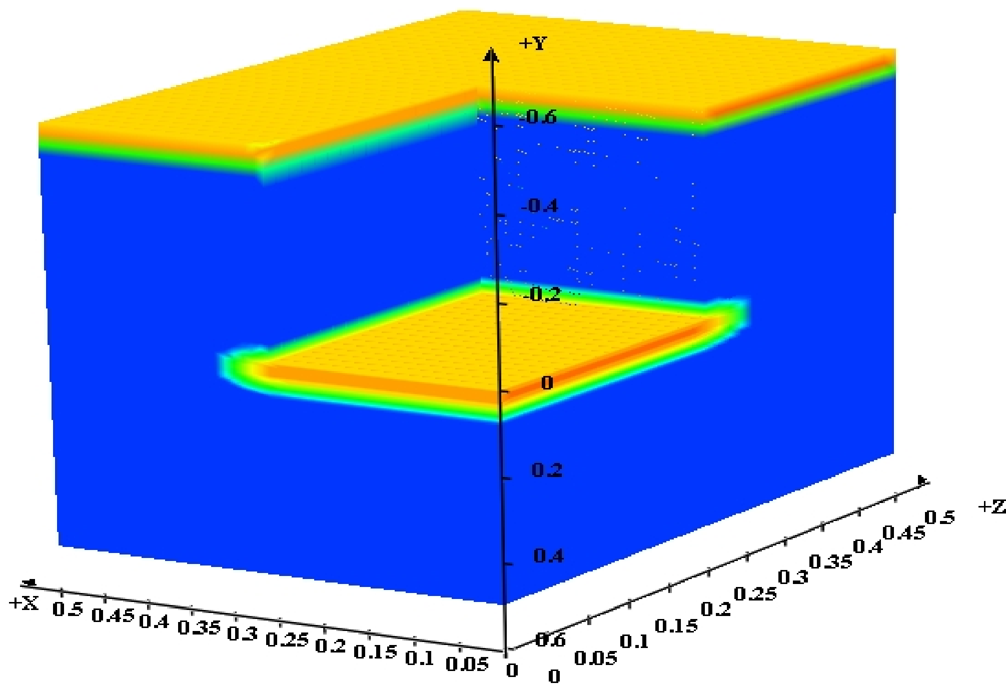
3D mask effects on Arsenic implant

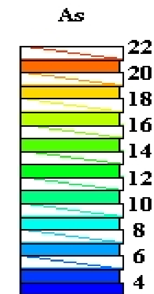


File Name : implant3d.str
File Type : CSuprem

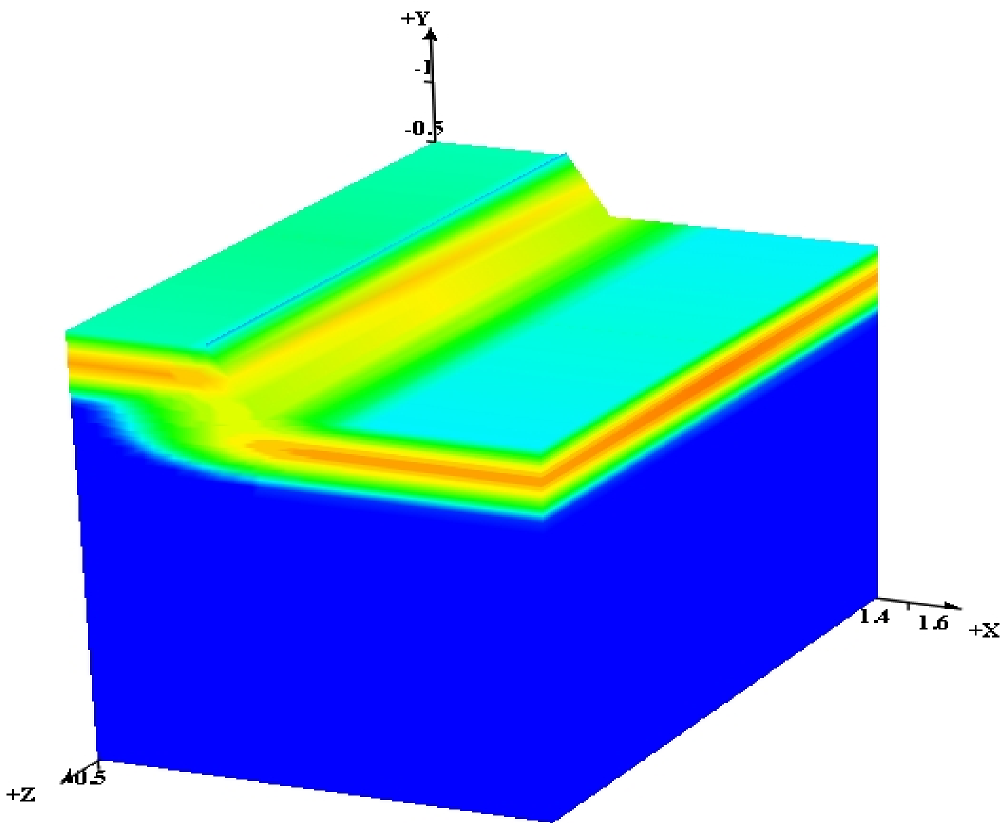
Variable Name :
As

3D Cube Contour Parameters :
X Range : 0 - 0.5
Y Range : -0.5 - 0.5
Z Range : 0 - 0.5

X Cut Line Num : 15
Y Cut Line Num : 15
Z Cut Line Num : 15



Lightly Boron doped drain

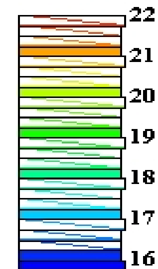


File Name : implant2.str
File Type : CSuprem

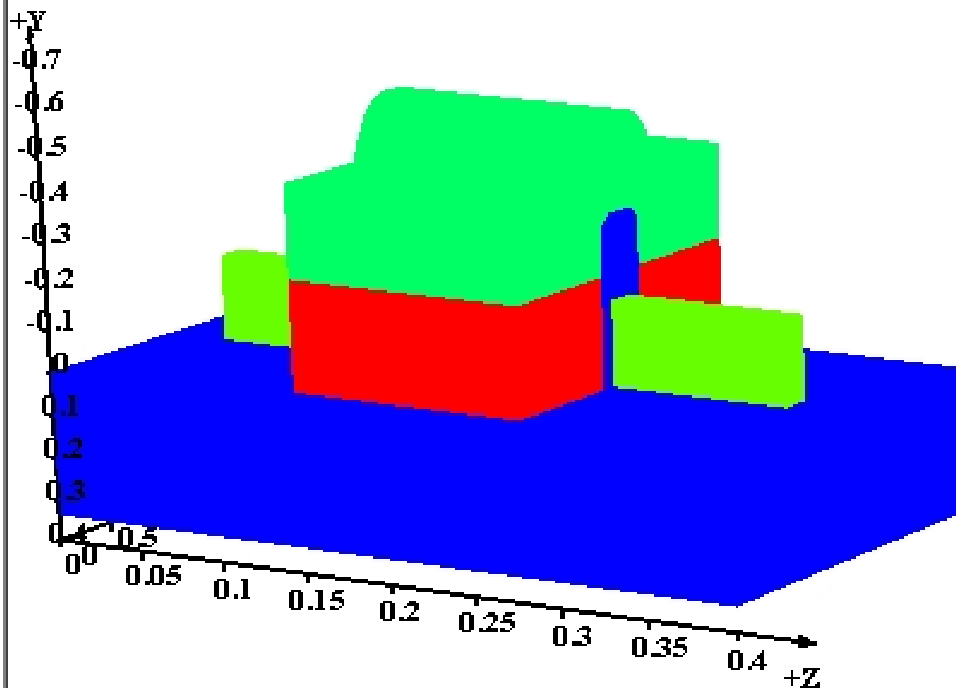
Variable Name :
B

3D Cube Contour Parameters :
X Range : 0 - 1.5
Y Range : -0.525 - 3
Z Range : 0 - 0.5

X Cut Line Num : 15
Y Cut Line Num : 15
Z Cut Line Num : 15



Independent Gate FinFET structure



File Name : FinFET.str
File Type : SUPREM

Variable Name :
Material Number

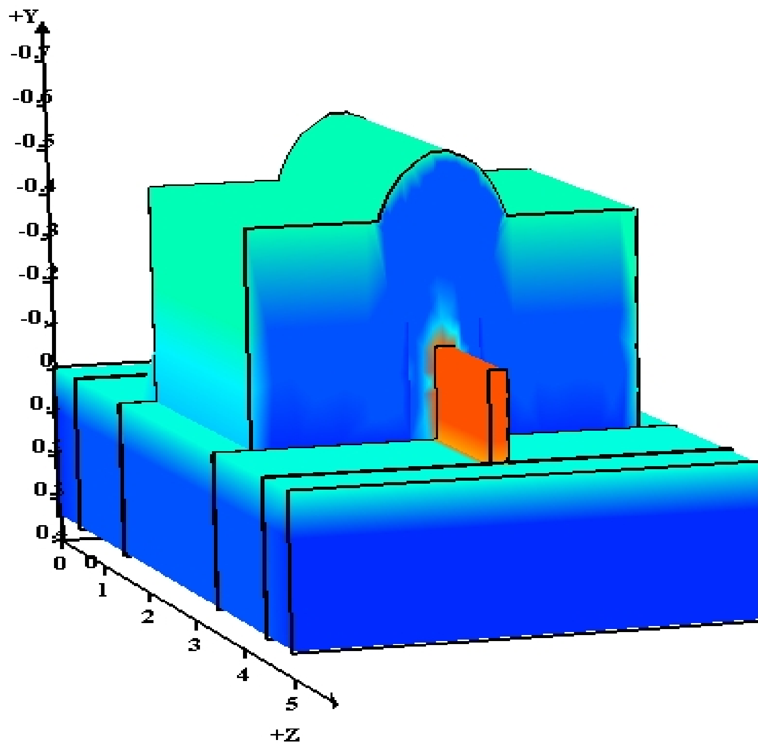
3D Cube Contour Parameters :
X Range : 0 - 2.6
Y Range : -0.62 - 0.34
Z Range : 0 - 0.4

X Cut Line Num : 15
Y Cut Line Num : 15
Z Cut Line Num : 15

Material Number

- SiNi (Region 6)
- Poly (Region 5)
- Poly (Region 4)
- SiO2 (Region 3)
- Si (Region 2)
- SiO2 (Region 1)

Boron active after diffusion



File Name : finfet.str
File Type : SUPREM

Variable Name :
Ba

3D Cube Contour Parameters :
X Range : 0 - 2.6
Y Range : -0.62 - 0.34
Z Range : 0 - 5

X Cut Line Num : 15
Y Cut Line Num : 15
Z Cut Line Num : 15

Ba