

# 1. NMOS

**AIM:** To study the N-MOSFET and plot the I-V characteristics curves using genius simulator.

## **PROCEDURE**

### **(1). Open Visual TCAD**

Right click on desktop → open in terminal → type **tcad** → Press enter and minimize this window until you want to close the GUI.

### **(2). Build the NMOS structure using coding scheme.**

#### **(a.) Create new text file**

**File → New → Text document**

#### **(b.) Write the code (overview)**

- Define the parameters like temperature, doping scale
- Define mesh type
- Define mesh in X,Y,Z coordinates
- Define regions and fill materials
- Define doping level as per the requirement in the regions
- Apply models -Apply bias
- Export the output file

The code for bulk NMOS is as mentioned below.

## 2D Coding:

```
#-----NMOS with triangular mesh -----#
```

```
GLOBAL T=300 DopingScale=1e15 resistivemetal=false
```

```
#-----MESHING-----#
```

```
MESH Type = S_Tri3
```

```
X.MESH WIDTH=0.12 N.SPACES=8
```

```
X.MESH WIDTH=0.035 N.SPACES=6
```

```
X.MESH WIDTH=0.09 N.SPACES=15
```

```
X.MESH WIDTH=0.035 N.SPACES=6
```

```
X.MESH WIDTH=0.12 N.SPACES=8
```

```
Y.MESH Y.TOP=-0.004 DEPTH=0.004 N.SPACES=4
```

```
Y.MESH DEPTH=0.015 N.SPACES=4
```

```
Y.MESH DEPTH=0.010 N.SPACES=4
```

```
Y.MESH DEPTH=0.005 N.SPACES=8
```

```
Y.MESH DEPTH=0.37 N.SPACES=10
```

```
#-----SPREAD-----#
```

```
#SPREAD Location=Left Width=0.125 Upper=0 Lower=2 Thickness=0.02 Encroach=1
```

```
#SPREAD Location=Right Width=0.125 Upper=0 Lower=2 Thickness=0.02 Encroach=1
```

```
#-----REGION-----#
```

```
REGION Label=N.SUBSTRATE Material=Si
```

```
REGION Label=N.Oxide IY.MAX=4 Material=Ox
```

```
REGION Label=N.Source X.MIN=0.0 X.MAX=0.155 IY.MAX=4 Material=Elec
```

REGION Label=N.Drain X.MIN=0.245 X.MAX=0.4 IY.MAX=4 Material=Elec

FACE Label=N.SUB Location=BOTTOM

FACE Label=N.GATE X.MIN=0.155 X.MAX=0.245 Location=Top

#-----DOPING-----#

DOPING Type=analytic

PROFILE Type=Uniform Ion=Acceptor N.PEAK=5E15 X.MIN=0.0 \

X.MAX=0.4 Y.TOP=0 Y.BOTTOM=0.4

PROFILE Type=analytic Ion=Acceptor N.PEAK=1E18 X.MIN=0.0 \

X.MAX=0.4 Y.TOP=0.00 Y.CHAR=0.02

PROFILE Type=analytic Ion=Donor N.PEAK=2E18 Y.Junction=0.005 \

X.MIN=0.0 X.MAX=0.15 XY.RATIO=1

PROFILE Type=analytic Ion=Donor N.PEAK=1E20 Y.Junction=0.02 \

X.MIN=0.0 X.MAX=0.120 XY.RATIO=0.5

PROFILE Type=analytic Ion=Donor N.PEAK=2E18 Y.Junction=0.005 \

X.MIN=0.25 X.MAX=0.4 XY.RATIO=1

PROFILE Type=analytic Ion=Donor N.PEAK=1E20 Y.Junction=0.02 \

X.MIN=0.280 X.MAX=0.4 XY.RATIO=0.5

Export VtkFile="NMOS2D.vtu" CgnsFile="NMOS2D.cgns"





