

# Hints, Tips and Solutions

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**Q. How can I create a non planar structure using III-V materials for Device Analysis when the materials I want to use are not in the *ATHENA* data base.**

**A. There are many materials in the *ATLAS* device simulator data base that are not in the *ATHENA* database, primarily because most of these exotic materials are usually deposited epitaxially and very little actual processing takes place in terms of implantation, diffusion and heat treatments.**

However, it is often desired to create a device with non vertical side-walls or a device where a non planar realistic deposit of an inter-layer di-electric plays a key role in the device operation. In these circumstances it is necessary to use the *ATHENA* process simulator. However, if the process simulator does not contain the exotic materials of interest in it's process data base, a user defined material must be used.

There is a special feature in the Silvaco process simulator, *ATHENA* , which converts unknown user defined materials into known device simulator materials so long as the user defined material is given the exact same name as the known device simulator material.

All that is required now to complete device construction in the process simulator, *ATHENA* , is to define the dopant materials as either donor or acceptor using the impurity statement.

An example of the first few lines of an *ATHENA* deck is given below. The example demonstrates how to define the user defined material as both the starting substrate material and as a deposited layer

The impurity statements define the polarity type of each dopant for each user defined material in the structure. The user defined materials are named using the material=<name> parameter. In this example, two materials are used that are unknown to *ATHENA* , namely GaN and AlGaN. However, since these materials are known to *ATLAS*, when the created structure is passed to *ATLAS* for device simulation, *ATHENA* will automatically convert the user defined materials into known *ATLAS* materials. Once again, care must be taken to ensure the user defined *ATHENA* material and it's corresponding known *ATLAS* material are named exactly the same.

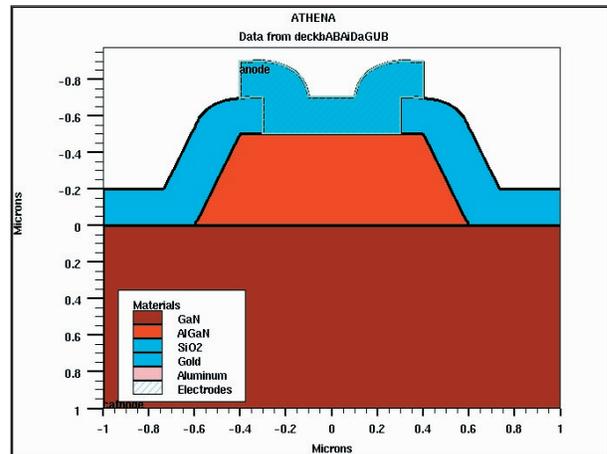


Figure 1. GaN/AlGaN non planar diode structure created in *ATHENA* with user defined materials which then get converted into known *ATLAS* materials.

```
go athena
```

```
line x loc=-1 spac=0.2  
line x loc=1 spac=0.2  
line y loc=0 spac=0.001  
line y loc=2 spac=1
```

```
impurity i.silicon material=GaN donor  
impurity i.silicon material=AlGaN donor  
impurity i.beryllium material=GaN acceptor  
impurity i.beryllium material=AlGaN acceptor
```

```
init material=GaN c.silicon=1e18  
deposit material=AlGaN thick=1  
c.silicon=1e18 divisions=8 dy=0.001 ydy=1
```

Using the material=<name> syntax throughout the input file, a complete non planar device can be created using any material known to the device simulator, *ATLAS* .

## Call for Questions

If you have hints, tips, solutions or questions to contribute, please contact our Applications and Support Department  
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