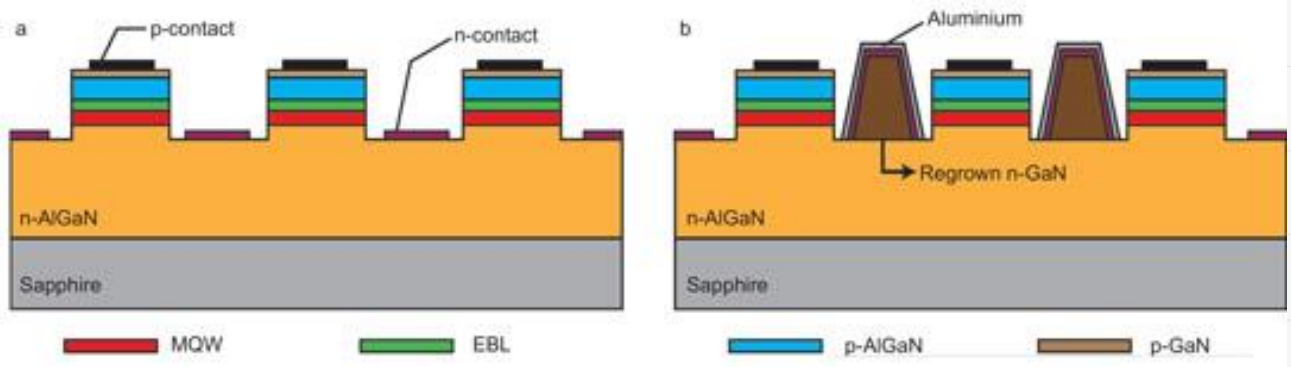
Wrocław University of Science and Technology

Advanced Optoelectronic project



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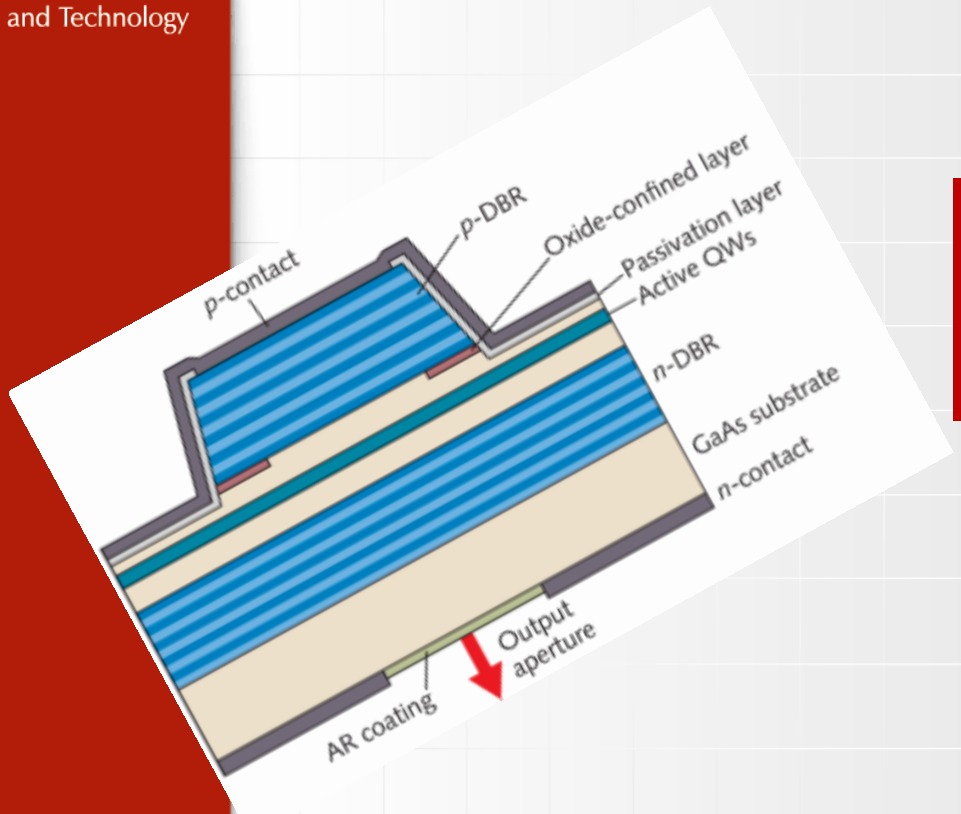
Wrocław University of Science and Technology

Advanced Optoelectronic project



Quantum structures

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Quantum structures

- Section of GaN LED structure
- .layer file with include .qw file
- .sol file

CROSSLIGHT Software Inc.

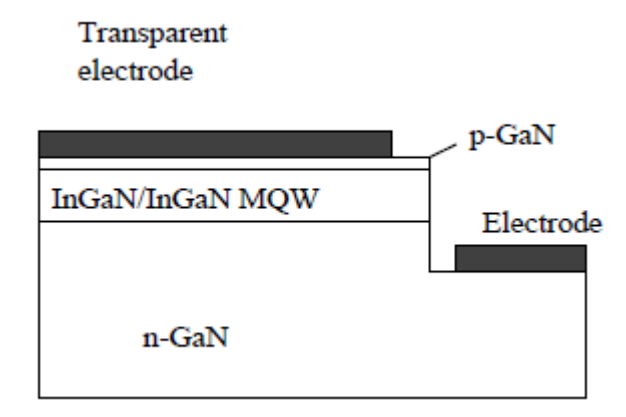
Simulation software by:

Crosslight Software Inc.

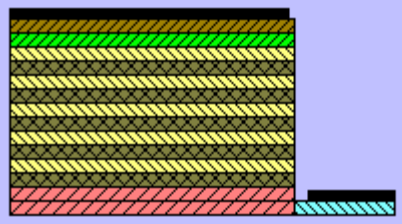
http://crosslight.com/

Section of GaN LED structure

Structure GaN LED



Definition GaN LED in Apsys



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GaN LED .layer file – part I

```
$ ----
begin_layer
$
column column_num=1 w=400.0  mesh_num=10  r=0.85
column column_num=2 w=140.0  mesh_num=8  r=1.15
top_contact column_num=1 from=0.0 to=390.0 contact_num=2
top_contact column_num=2 from=20.0 to=140.0 contact_num=1
$
layer_mater macro_name=gan  column_num=1
layer_mater macro_name=gan  column_num=2
layer d=2.  n=5   r=0.8 n_doping1=5.e24 &&
  n_doping2=1.e24
layer_mater macro_name=gan  column_num=1
layer_mater macro_name=void  column_num=2
layer d=2.  n=5   r=0.9 n_doping1=5.e24 xp2=1
$
$ ----
include file=ganled.qw
include file=ganled.qw
include file=ganled.qw
include file=ganled.qw
include file=ganled.qw
$ ----
```

Important informations are red!

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GaN LED .layer file – part II

```
$
layer_mater macro_name=gan column_num=1
layer_mater macro_name=void column_num=2
layer d=0.2 n=4  r=1.0 p_doping1=5.e24
$
layer_mater macro_name=gan column_num=1
layer_mater macro_name=void column_num=2
layer d=0.1 n=3  r=1.0 p_doping1=2.e25
$
end_layer
```

Important informations are red!

Simulation software by:

Crosslight Software Inc.

http://crosslight.com/

GaN LED .qw file (include)

Simulation software by:

Crosslight Software Inc.

http://crosslight.com/

```
$
$ In(0.08)Ga(0.92)N Barrier : 5nm$ In(0.4) Ga(0.6) N Well : 3nm
$
layer_mater macro_name=ingan var1=0.4 column_num=1 &&
  active_macro=InGaN/InGaN avar1=0.4 avar2=0.08 avar3=300
layer_mater macro_name=void column_num=2 &&
  active_macro=void
layer d=0.003 n=3 r=1 xp1=1 xp2=1
$
layer_mater macro_name=ingan var1=0.08 column_num=1
layer_mater macro_name=void column_num=2
layer d=0.005 n=3 r=1 xp1=1 xp2=1
$
$
```

Important informations are red!

GaN LED – include - information

include

parameter	data type	values [defaults]
file	char	[void]

include is used to include another file as part of the present input file. It may also be used in the .layer input files.

- **file** is the name of the file to be included.

Example(s)

```
include file=laser1.doping
```

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GaN LED .sol file – part I

```
$file:ganled.sol
$ *******
begin
load_mesh mesh_inf=ganled.msh
output sol_outf=ganled.out
$ *******
include file=ganled.doping
include file=ganled.mater
$-------------------------
$led_control wavelength=0.465 efficiency_model=uniform &&
$  refl_y1=0.3 refl_y2=0.3 delta_wavel=0.03 &&
$  led_xrange=(0 400) group_index=2.9
$
$-------------------------
$ external parasitic circuit with 2 Ohm resistor
$ z-dimension is assumed to be 100 um
external_cir type=resistor value=2 z_dim=100 contact=2
restart data_set=4
$
```

CROSSLIGHT Software Inc.

Simulation software by:

Crosslight Software Inc.

http://crosslight.com/

GaN LED .sol file – part II

```
$ optical field
$
sor_par  max_iter=0 print_sor=noprint
init_wave point_ll=(0., 0.0) point_ur=(400, 4.34) &&
  length=500 backg_loss=1000. &&
  boundary_type=(1 1 1 1 )  init_wavel=0.465 mirror_ref=0.32 &&
  wavel_range=(0.43, 0.48)
optical_field profile=gaussian  &&
  x_prof=(0 400  0.1 0.1) y_prof=(4.0  4.34  0.1 0.1)
multimode mode_num=1
$
$ start solving
$
newton_par damping_step=5. max_iter=100 print_flag=3
equilibrium
newton_par damping_step=1. print_flag=3 var_tol=1.e-4
scan var=voltage_1 value_to=-4. print_step=4. &&
  init_step=0.2 min_step=1.e-5 max_step=2.5
scan var=current_1 value_to=180.  print_step=60 &&
  init_step=1.5 min_step=1.e-5 max_step=10.
end
```

CROSSLIGHT Software Inc.

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End of Quantum structures