Static IV model

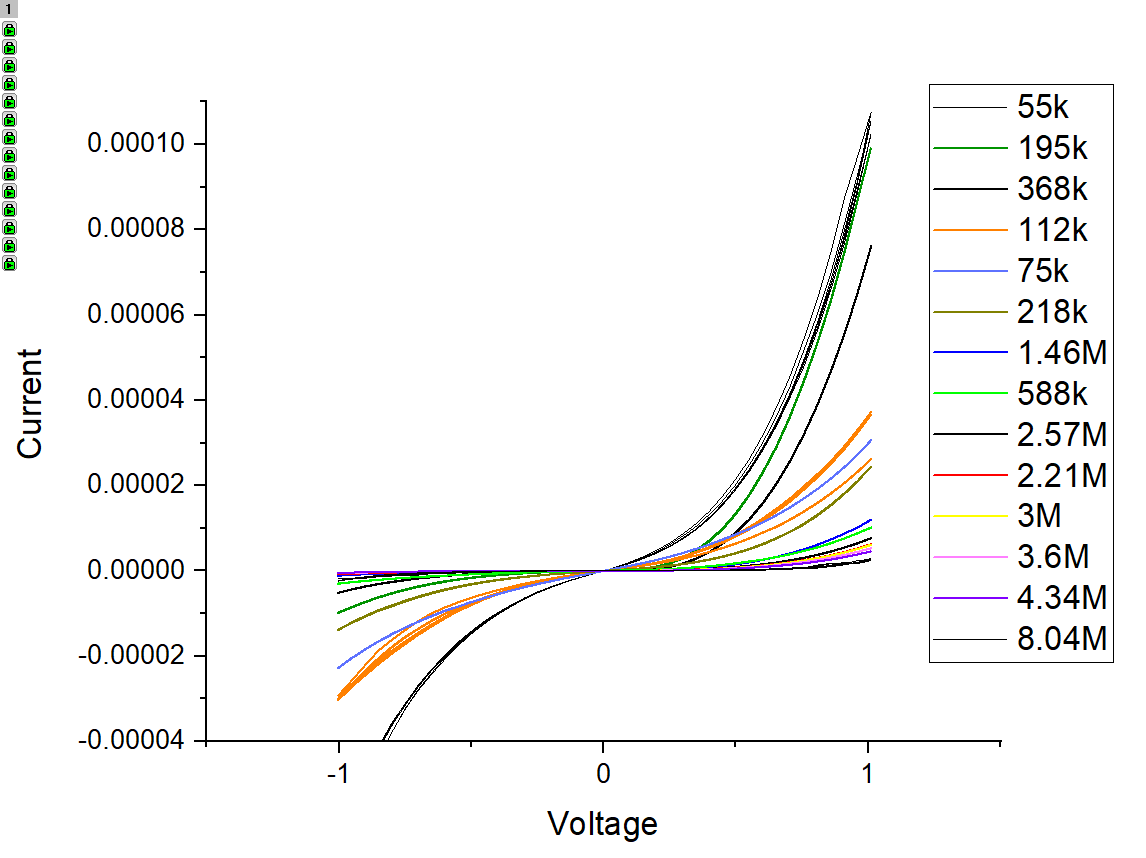
**Full set of model parameters**:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **RS** | **ap** | **bp** | **an** | **bn** |
| 999 | 22.88709 | 0.04343 | -20.53944 | -0.04855 |
| 10k | -0.43039 | -1.78085 | 0.50986 | 1.52572 |
| 55k | -0.35987 | 2.82976 | 0.33104 | 2.43618 |
| 75k | -0.42758 | -1.82703 | 0.51209 | 1.45155 |
| 112k | -0.4214 | -2.38545 | 0.52962 | 2.01312 |
| 195k | -0.65497 | -3.43872 | 0.08506 | 3.17822 |
| 218k | -0.25896 | -3.05027 | 0.31266 | 2.36684 |
| 368k | -0.75723 | -3.64433 | 0.06359 | 3.43545 |
| 588k | -0.30703 | -3.00806 | 0.29435 | 1.93992 |
| 1.46M | -0.50965 | -3.56527 | 0.04667 | 3.58846 |
| 2.21M | -0.36589 | -3.64183 | 0.08408 | 3.06675 |
| 2.57M | -0.48023 | -3.72994 | 0.03581 | 3.82722 |
| 3.03M | -0.43717 | -3.75326 | 0.03588 | 3.89174 |
| 3.6M | -0.44249 | -3.77579 | 0.02982 | 4.30501 |
| 4.34M | -0.45142 | -3.79227 | 0.03928 | 3.97381 |
| 8.04M | -0.10486 | -5.27177 | 0.35218 | 3.97053 |

**Device stack specification**: Au/TiO/Pt

**Area**: 20u x 20u

**Static IV plots:**



**Verilog-A code**:

`include "disciplines.vams"

`include "constants.h"

//Defines the Verilog-A module and device electrical terminals p,n.

module analytical (p, n);

inout p, n;

electrical p, n;

//Initial resistive state

parameter real RS = 218000;

//I-V relationship parameters

// v>0

parameter real ap=-0.25896;

parameter real bp=-3.05027;

// v<0

parameter real an=0.31266;

parameter real bn=2.36684;

real vin; // Variable that tracks the input voltage.

real IVp; // Positive branch of the IV relationship

real IVn; // Negative branch of the IV relationship

real IV; // Full IV relationship

//Implementation of the step function

analog function integer stp; //Stp function

real arg; input arg;

stp = (arg >= 0 ? 1 : 0 );

endfunction

analog begin

//Assigns the voltage applied at the terminals of the device on 'vin'

vin=V(p,n);

//The two branches of the I-V expression

IVp=ap\*(1/RS)\*(1-exp(-bp\*vin));

IVn=an\*(1/RS)\*(1-exp(-bn\*vin));

//Device I-V expression

IV=IVp\*stp(vin)+IVn\*stp(-vin);

//Current flowing through the module's port

I(p, n)<+ IV; // Ohms law

end

endmodule