Study of the Thermal Behavior of Solar Cells Based on GaAs

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Introduction

The two main advantages of solar concentration in photovoltaic (PV) cells are:
- Reduction of the PV conversion active surface;
-Increase of cells efficiency.
Here we are studying GaAs thermistors at equilibrium condition.

Fabrication technology

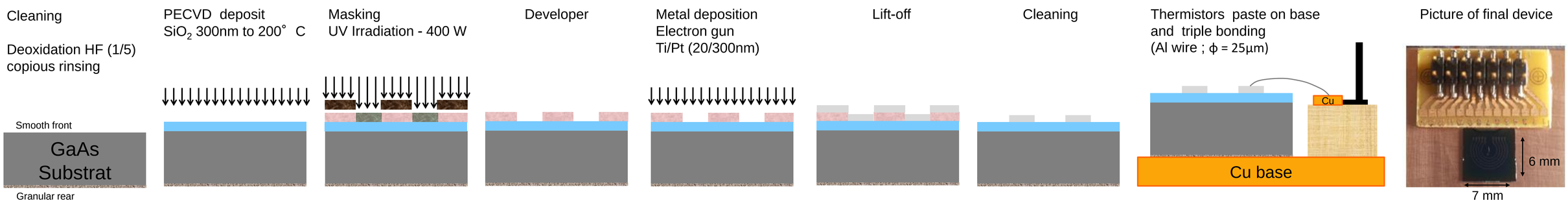

Figure 1. Process fabrication

Computational Methods

The following equations are used to simulate the heat transfer and solar flow:

$$\rho C_p u \nabla T = \nabla.(k \nabla T) + Q$$

$$-n.(-k\nabla T) = \mathrm{h}.(\mathrm{T_{ext}} - \mathrm{T})$$

$$Q(x,y,z) = \mathrm{P_0}.\frac{A_c}{\pi\sigma_x\sigma_y e^2} e^{-\left[\frac{(x-x_0)^2}{2\sigma_x^2}+\frac{(y-y_0)^2}{2\sigma_y^2}\right]}.e^{-A_c z}$$

Simulated model with boundary conditions

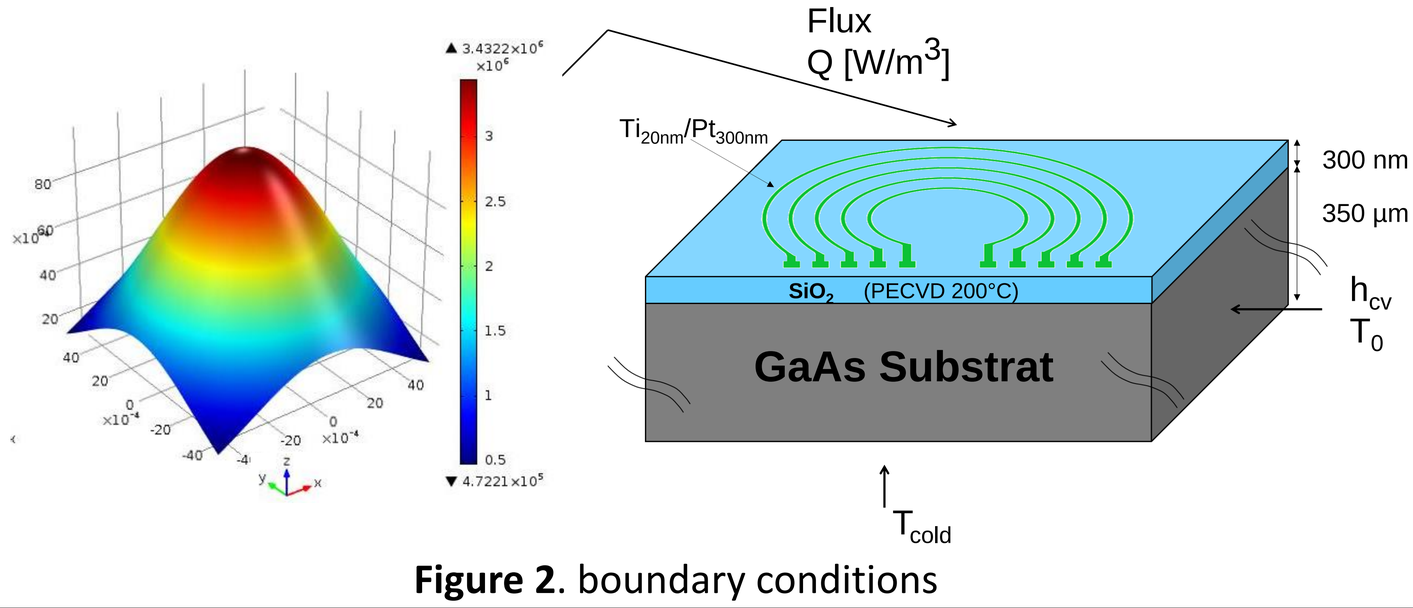

Figure 2. boundary conditions

Results

Results of simulation with Multiphysics COMSOL Software:

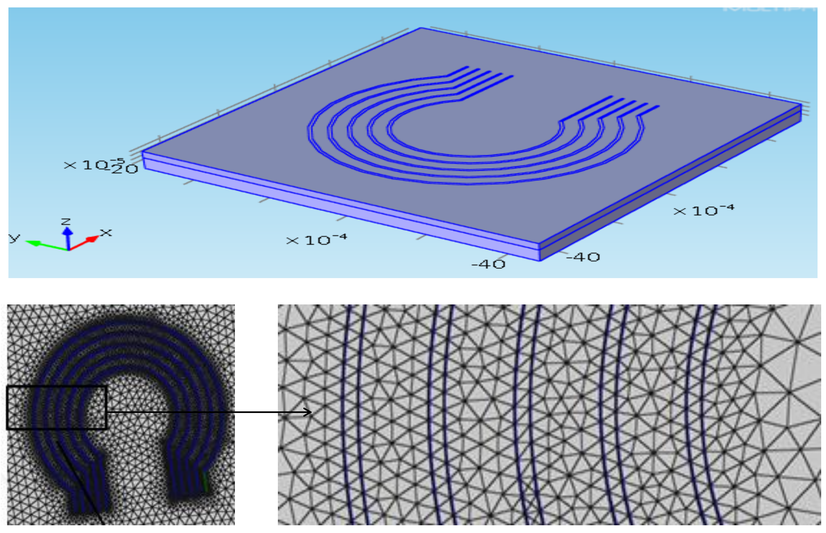

Figure 3. Structure meshes

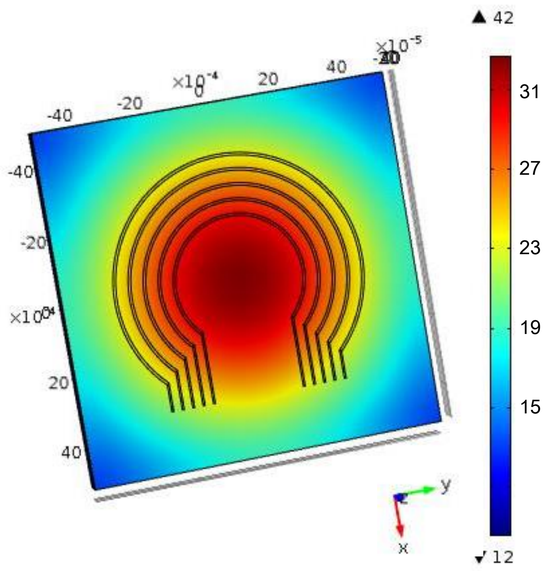

Figure 4. Field of temperature

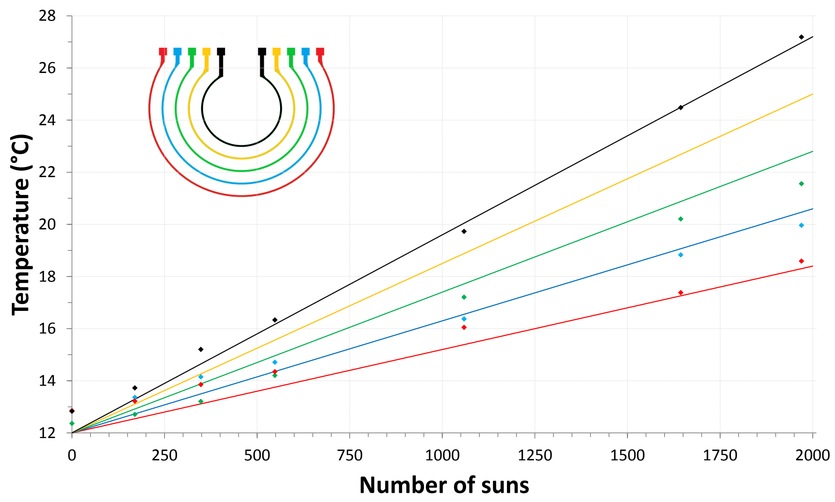

Figure 5. Experimental results & temperatures in the termistors

Conclusions and perspectives

-The experimental results are validated by the simulated model.
-Thermoresistors tests on the way.
- Need to find a simple and low-cost way to cool down the PV cell at high concentration.

References

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