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C:\Users\EM\Documents\QuantumCurrent.m

EDITOR PUBLISH VIEW
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FILE NAVIGATE CODE ANALYZE SECTION RUN

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
3 %
4 %   Programmed by : E. Moreno
5 %   Date          : 24/5/2022
6 %   Institution   : CTU in Prague
7 %   Description    : This program determines
8 %                   the quantum tunneling
9 %                   current for a junction
10 %                  metall-insulator-metal2.
11 %   Setup         : Forward bias is assumed
12 %
13 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
14 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
15
16 % INPUT>
17 %   Thickness      : This parameter accounts for the geometric width of
18 %                   the quantum potential barrier. This potential barrier
19 %                   represents the insulator between metals.
20 %   Bias           : Electric potential that polarizes the insulating
21 %                   metal-metal junction and thus establishes an electric
22 %                   field inside the dielectric.
23 %   Temperature1   : Average temperature of the tungsten metallic interface
24 %                   in contact with the dielectric
25 %   Temperature2   : Average temperature of the titanium metallic interface
26 %                   in contact with the dielectric
27 % OUTPUT>
28 %   Jt             : Current density in a per square meter which passes
29 %                   directly from one metal to another by quantum tunneling.
30 %                   IS units [A/m^2].

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28 %   Jt             : Current density in a per square meter which passes
29 %                   directly from one metal to another by quantum tunneling.
30 %                   IS units [A/m^2].
31
32 function Jt=QuantumCurrent(Thickness,Bias,Temperature1,Temperature2)
33
34
35 logi = true;
36
37 %Units:
38 %   Thickness      = [1.8e-9 1.9e-9 2.0e-9] in meters
39 %   Bias           = [0.8 0.8 0.85] in volts (it's the potential that bias
40 %                   the MIM junction)
41 %   Temperature1   = [350 350 350] in kelvin
42 %   Temperature2   = [420 420 420] in kelvin
43
44 % Fundamental constants used in this algorithm.
45 qe = 1.602176487e-19; % Coulomb
46 me = 9.10938215e-31;  % Kilogram
47 hbar = 1.054571628251774e-34; % Joule Second
48 kb = 1.3806504e-23;   % Joule/Kelvin
49
50 % Data of the materials used in this connection configuration
51 % metall-insulator-metal2.
52 Ef = 1.5; % eV
53 wfw = 4.5; % eV
54 wfti = 4.33; % eV
55 ChiHfO = 2; % eV
56 er=25; % HfO2
57

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