Conductance Modeling Of Flexible Organic Thin Film Solar Cell Devices

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Abstract

In this research work, we developed a virtual model to examine the electrical conductivity of multilayered thin films when positioned above a single layer and multilayers of graphene, and flexible polyethylene terephthalate (PET) substrate. Additional structured thin films were configure as follows: organic layers of poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) as a hole conducting layer, poly(3-hexylthiophene-2,5-diyl) (P3HT), as p-type, phenyl-C61-butyric acid methyl ester (PCBM) as n-type, with aluminum (Al) added as a top conductor. COMSOL Multiphysics® was the primary simulation tool used to develop the virtual model, and analyze variations in electric potential and conductivity throughout the thin-film structural system. Using the AC/DC Module and Electric Currents interface we defined the geometry of each model and input properties for each tested configurations: PET/graphene/PEDOT:PSS/P3HT/PCBM/aluminum. We analyzed the model with varying thicknesses of graphene and active layers (P3HT/PCBM). This simulation allowed us to analyze the electrical conductivity, and visualize the model with varying voltage potential, and bias across the plates to better visualize the configurations useful in fabricating organic thin films relevant in solar device applications.

Figures used in the abstract

Figure 1 : 3D model depicting the electric potential when ±5V is applied across conducting layers.

Figure 2 : Image 2: The electric potential variation across the multilayered system (z-axis) when ±5V is applied across conducting layers.