# Persistent Internal Photopolarization in C60 Thin Films

Eugene Katz,[1] David Faiman[1] and Viktor Lyubin[2]

[1]Ben-Gurion University of the Negev
Department of Solar Energy and Environmental Physics,
J. Blaustein Institute for Desert Research
Sede Boqer 84990
Israel

[2]Ben-Gurion University of the Negev
Department of Physics
Beersheba 84105
Israel

We report on a persistent internal photopolarization effect observed in C60 thin films at room temperature.

C60 thin films were evaporated on optical glass substrates which had been predeposited with a pair of coplanar Ag electrodes having a variety of gap widths and lengths, using a vacuum deposition technique. The starting powder was commercially obtained C60 (99.98AG. The deposition rate was about 1 nm/sec and the thickness of the films was in the range 200 - 400 nm. Two-probe coplanar conductivity measurements were carried out at room temperature with an HP 4140 pA Meter/DC voltage source. The samples were irradiated by a solar simulator (Steuernagel "Solar Constant 575").

In our experiments, a voltage bias was applied between the coplanar electrodes and the sample was irradiated by light. Then the light was turned off, but the voltage bias remained in effect. During the irradiation period an internal electric field with opposite direction to the bias field was found to be generated in the sample, due to a movement of photo-excited electrons and holes in opposite directions under the action of the external field, and their subsequent trapping at defect centers near the electrodes. I.e. the sample was photopolarized. This internal field leads to a change of the current sign after switching off the external field and to the "negative" photocurrent flow after turning on the light the second time (without any external field!).

The observed phenomenon differs from the similar "photoelectret" state previously seen in some other materials in that, unlike the latter, C60 film does not undergo rapid photodepolarization.

We suggest to utilize this phenomenon in fullerene-based solar cells. A possible operation principle of such a device may combine permanent built-in potential with repeatable photopolarization of a fullerene layer (phase).