**Dr. Nam Nguyen**

Editorial Board of Journal of Visualized Experiments

**Re: Revised submission of manuscript titled** “Indacenodithienothiophene-Based Ternary Organic Solar Cells: Concept, Devices and optoelectronic analysis.” by the authors Nicola Gasparini, Amaranda García-Rodríguez, Athanasios Katsouras, Apostolos Avgeropoulos, Georgia Pagona, Vasilis G. Gregoriou, Christos L. Chochos, Sybille Allard, Ulrich Scherf, Christoph J. Brabec and Tayebeh Ameri

January, 21st 2016

Dear Dr. Nam Nguyen,

Thank you very much for your letter from January 12th, 2016 and for your comments on our paper entitled "Indacenodithienothiophene-Based Ternary Organic Solar Cells: Concept, Devices and optoelectronic analysis.” by the authors Nicola Gasparini, Amaranda García-Rodríguez, Athanasios Katsouras, Apostolos Avgeropoulos, Georgia Pagona, Vasilis G. Gregoriou, Christos L. Chochos, Sybille Allard, Ulrich Scherf, Christoph J. Brabec and Tayebeh Ameri. We have carefully read the reports and agree with most of the issues raised, whom we thank for your valuable comments. Following closely their advice, we have revised the manuscript accordingly. We hope you will find the manuscript in suitable form for publication in Journal of Visualized Experiments. Thank you for your consideration.

Yours Sincerely,

Nicola Gasparini

What is the size of the column in step 2.4?  
The size of the column is I.D. × L 25 mm × 300 mm.   
As currently written, step 6 cannot be filmed.  
  
In step 6.1.1/6.1.3, what is used to measure the J-V characteristics? How was the measurement done and what are the parameters? Again, you cannot reference the specifics of the procedural detail. How many measurements are taken? For how long? etc.  
In order to make clear how the JV characteristics are taken, we reported a schematic of the setup (Fig 1).



**BoTEst Unit**

**Sample**



**Keithley Unit**

**Power Supply**

**Peltier Element**

**Sample**

Fig. 1: Schematic experimental setup to measure J-V characteristics of the devices under ambient condition.

Specifically, we scan the voltages between -2V and 2V with a V=20mV and point by point we obtained the corresponding current (I). The current density (J) is then calculated by the equation J=I/A, where A is the area of the solar cells (10.4 mm2 in our case).

In step 6.2.1, how much was used to measure UV-Vis spectrum? Was there a dilution?  
The UV-VIS spectra are taken directly on film, not in solution, therefore no dilution are needed.

For step 6.3.2, please specify that the BNC cables are used to connect the oscillator. Can a supplemental figure be provided for scripting?

Done.  
  
For step 6.3.3, please explain the variable time delay briefly in the protocol. This is necessary if you want this step filmed.

Done.  
  
For step 6.5.3, where did the analog switch come from? A supplemental figure is necessary here.

The analog switch, also called the bilateral switch, is an electronic component that behaves in a similar way to a relay, but has no moving parts. I cannot take a picture because is an homemade system. During the filming on the oscilloscope will be clear the function of the analog switch.

How is the lock in technique performed? Please explicitly detail how this standard technique is performed, especially if this is to be filmed.  
  
How is the mechanical chopper used? What is done?  
In order to make clear how the PIA spectroscopy is working, we reported a schematic of the setup (Fig 2).



Fig. 1: Schematic experimental setup to measure J-V characteristics of the devices under ambient condition.

In this method the excitation (laser PUMP) is done by using a green laser (=532 nm), which is modulated by a mechanical chopper. The sample is additionally illuminated by a monochromated light beam (“probe”) of a white light source. First the sample’s transmittance and the sample’s photoluminescence is measured. The measured signal is analysed with a lock-in amplifier using the chopper frequency as the reference signal, allowing a very precise quantification of the change in absorption induced by the pump-light. Using various detectors (Si, Ge) a broad wavelength region ranging from 400nm up to 1800nm can be analysed. Varying the material composition, material dependent effects can be characterized.

2. Please discuss the significance of the technique with respect to other methods, the critical steps of the protocol, and any modifications/troubleshooting that can be performed. This must be explicit.

Done.