Claims

1. An organic electronic device comprising:

(i) a first conductive layer and a second conductive layer;

(ii) an organic layer disposed between said first and second conductive layer; and

(iii) an amphiphilic monolayer having a plurality of single amphiphilc molecules disposed between said organic layer and the second conductive layer.

2. The device according to claim 1, wherein said organic electronic device is a bulk heterojunction organic photovoltaic (OPV) device.

3. The device according to claims 1 or 2, wherein the first conductive layer serves as an anode.

4. The device according to claim 3, wherein said anode is transparent.

5. The device according to claim 4, wherein said transparent anode comprises a transparent substrate with a transparent conducting oxide.

6. The device according to any of the preceding claims, wherein said second conductive layer serves as a cathode.

7. The device according to claim 6, wherein said cathode comprises materials selected from the group consisting of Ca, Li, Ba, Mg, Al, Ag, Ag, halogen salts of Li, Li salt alloys with Al and combinations thereof.

occurs due to the incompact connection structure. This degradation process leads to an initial efficiency loss termed "burn-in", which has been shown to be primarily the result of a drop in both fill factor (FF), open-circuit voltage (V_{OC}), and to a lesser extent, the short circuit current (J_{SC}) in the first 100 hours.

The underlying mechanism causing the "burn-in" which results in a loss of approximately 25 percent of the initial efficiency is not well understood but this "burn-in" phenomenon is known to result in the real efficiency of an OPV device to be less than 80 percent of the reported value.

Subsequently, researchers have capitalized on the use of interlayers to circumvent the direct contact between the organic photoactive donor and electrodes where high densities of carrier traps and interface dipoles can hinder efficient charge collection. Although anode interlayers have shown some success, effective cathode interlayers have been difficult to achieve due to unavailability of materials that are compatible with the cathode such that problems associated with "burn-in" of the BHJ OPV devices can be overcome.

There is therefore a need to provide an organic photovoltaic device that overcomes, or at least ameliorates, one or more of the disadvantages described above.

There is also a need to provide a method for fabricating organic photovoltaic devices that overcomes, or at least ameliorates, one or more of the disadvantages described above.

Summary

In the present disclosure, there is provided an organic electronic device comprising:

(i) a first conductive layer and a second conductive layer;

(ii) an organic layer disposed between said first and second conductive layer; and

(iii) an amphiphilic layer disposed between said organic layer and the second conductive layer.

In one aspect, there is provided an organic electronic device comprising:

(i) a first conductive layer and a second conductive layer;

(ii) an organic layer disposed between said first and second conductive layer; and

(iii) an amphiphilic monolayer having a plurality of single amphiphilc molecules disposed between said organic layer and the second conductive layer.

The organic electronic device may comprise OPV devices, organic light-emitting diodes, organic thin-film transistors, biological sensors, or chemical sensors. The first and second conductive layers may serve as the anode and cathode respectively.

Advantageously, the presence of an amphiphilic layer in such devices, disposed between the organic layer and the second conductive layer may mitigate photo-stability and thermal stability issues. The amphiphilic layer separates the organic layer from the conductive cathode metal. This may help to prevent any possible interactions between the layers that can result in the degradation of the device, particularly in the presence of light or heat. Further advantageously, the amphiphilic layer may circumvent the diminishing of the power conversion efficiency of the OPV by preventing moisture and oxygen diffusion into the interface between the organic layer and the conductive cathode metal, as well as metal diffusion from the cathode layer into the organic layer. By avoiding direct contact between the organic layer and the metal cathode,

the amphiphilic layer may allow the device to circumvent high densities of carrier traps and interface dipoles that can hinder efficient charge collection.

Advantageously, the amphiphilic layer may be a monolayer. This amphiphilic monolayer may enhance the connection between the organic layer and the metal cathode not only because of the above advantage in circumventing carrier traps but also because it may act as an efficient carrier channel. Moreover, the

amphiphilic monolayer may provide a more compact connecting structure that may aid the stabilization of the interface between the organic layer and the metal cathode, thereby overcoming poor thermal stability and undesired charge trapping arising from incompact connection structure.

More advantageously, the amphiphilic layer may improve the lifetime and power conversion efficiency of the organic electronic device as it mitigates the above degradation issues by preventing diffusion and reactions between the organic layer and the second conductive layer.

The provision of the amphiphilic monolayer may overcome the limitation that suitable materials compatible between the organic layer and the metal cathode are lacking, without compromising the fill factor (FF), open-circuit voltage (V_{OC}), and the short circuit current (J_{sc}) of the device.

In the present disclosure, there is provided a method for fabricating an organic electronic device, comprising:

(i) forming a first conductive layer;

(ii) spin coating a mixture of organic materials on said first conductive layer to form an organic layer;

(iii) inserting an amphiphilic layer between said organic layer and a second conductive layer; and

(iv) depositing said second conductive layer after inserting said amphiphilic layer.

In another aspect, there is provided a method for fabricating an organic electronic device, comprising:

(i) forming a first conductive layer;

(ii) coating a mixture of organic materials on said first conductive layer to form an organic layer;

(iii) inserting an amphiphilic monolayer having a plurality of single amphiphilic molecules between said organic layer and a second conductive layer; and

(iv) depositing said second conductive layer after inserting said amphiphilic monolayer.

The provision of an amphiphilic layer in organic electronic devices, which may be a monolayer, provides the abovementioned advantages. This amphiphilic monolayer is inserted via any deposition method, e.g., spin coating, such that the monolayer is disposed between the organic layer and metal cathode in order to overcome the above issues, in particular the high densities of carrier traps and interface dipoles that can hinder efficient