Claims

What is claimed is:

1. A self-powered sensor, comprising:

a solar cell configured to at least substantially absorb light of a first wavelength range for generating electrical energy and configured to at least substantially transmit light of a second wavelength range;

an energy storage coupled to the solar cell for storing the electrical energy generated by the solar cell; and

a detector electrically connected to the energy storage to receive the electrical energy, and configured to detect the transmitted light of the second wavelength range;

wherein the solar cell includes an electrode configured to have at least one of a selected thickness or a selected material dependent on a desired absorptance of the solar cell for light of the first wavelength range and a desired transmittance of the solar cell for light of the second wavelength range, wherein the electrode is transparent or semi-transparent;

wherein the first wavelength range comprises a wavelength range of visible light, and the second wavelength range comprises a wavelength range of infrared light;

wherein the detector is an infrared detector configured to detect the transmitted light of the second wavelength range comprising the wavelength range of infrared light; and

wherein the solar cell is configured to act as a noise filter by at least substantially absorbing light of the first wavelength range comprising the wavelength range of visible light.

2. The self-powered sensor of claim 1,

wherein the electrode is configured to have at least one of the selected thickness or the selected material to optimize at least one of an absorptance of the solar cell for light of the first wavelength range or a transmittance of the solar cell for light of the second wavelength range.

3. The self-powered sensor of claim 1 or claim 2,

wherein the selected thickness of the transparent electrode is selected from a range of 60nm to 120nm; or

wherein the selected thickness of the semi-transparent electrode is selected from a range of 60nm to 170nm.

4. The self-powered sensor of any one of claims 1 to 3,

wherein the selected material of the transparent electrode comprises an indium tin oxide layer.

5. The self-powered sensor of any one of claims 1 to 3,

wherein the selected material of the semi-transparent electrode comprises an indium tin oxide layer and a silver layer.

6. The self-powered sensor of claim 5,

wherein the semi-transparent electrode comprises the indium tin oxide layer with a thickness of about 60nm and the silver layer with a thickness of about 20nm.

7. The self-powered sensor of any one of claims 1 to 6, wherein the solar cell comprises:

a transparent substrate;

an electron transporting layer arranged on the transparent substrate;

an active layer arranged on the electron transporting layer ;

a hole transporting layer arranged on the active layer; and

the transparent or semi-transparent electrode arranged on the hole transporting layer.

8. The self-powered sensor of any one of claims 1 to 7,

wherein the detector is sequentially aligned with the solar cell along a direction of light transmission path to receive the light transmitted through the solar cell.

9. The self-powered sensor of any one of claims 1 to 8,

wherein the detector is arranged to contact or face a surface of the solar cell from which the light of the second wavelength range is transmitted.

10. A method of forming a self-powered sensor, the method comprising:

selecting at least one of a thickness or a material for an electrode of a solar cell, dependent on a desired absorptance of the solar cell for light of a first wavelength range and a desired transmittance of the solar cell for light of a second wavelength range, wherein the electrode is transparent or semi-transparent;

providing the solar cell having the electrode with the selected at least one of the thickness or the material, the solar cell being configured to at least substantially absorb light of the first wavelength range for generating electrical energy and configured to at least substantially transmit light of the second wavelength range;

coupling an energy storage to the solar cell for storing the electrical energy generated by the solar cell; and

electrically connecting a detector to the energy storage to receive the electrical energy, and to detect the transmitted light of the second wavelength range;

wherein the first wavelength range comprises a wavelength range of visible light, and the second wavelength range comprises a wavelength range of infrared light;

wherein the detector is an infrared detector configured to detect the transmitted light of the second wavelength range comprising the wavelength range of infrared light; and

wherein the solar cell is configured to act as a noise filter by at least substantially absorbing light of the first wavelength range comprising the wavelength range of visible light.

11. The method of claim 10, further comprising:

selecting at least one of the thickness or the material of the electrode to optimize at least one of an absorptance of the solar cell for light of the first wavelength range or a transmittance of the solar cell for light of the second wavelength range.

12. The method of claim 10 or 11, further comprising:

selecting the thickness of the transparent electrode from a range of 60nm to 120nm; or

selecting the thickness of the semi-transparent electrode from a range of 60nm to 170nm.

13. The method of any one of claims 10 to 12, further comprising:

selecting the material of the transparent electrode to include an indium tin oxide layer.

14. The method of any one of claims 10 to 12, further comprising:

selecting the material of the semi-transparent electrode to include an indium tin oxide layer and a silver layer.

15. The method of claim 14, further comprising:

selecting the thickness and the material of the semi-transparent electrode to include the indium tin oxide layer with a thickness of about 60nm and the silver layer with a thickness of about 20nm.

16. The method of any one of claims 10 to 15, wherein providing the solar cell further comprises:

providing a transparent substrate;

forming an electron transporting layer on the transparent substrate;

forming an active layer on the electron transporting layer;

forming a hole transporting layer on the active layer; and

forming the electrode on the hole transporting layer.

17. The method of any one of claims 10 to 16, further comprising:

sequentially aligning the detector with the solar cell along a direction of light transmission path to receive the light transmitted through the solar cell.

18. The method of any one of claims 10 to 17, further comprising:

arranging the detector to contact or face a surface of the solar cell from which the light of the second wavelength range is transmitted.