

What is claimed is:

1. An image sensor, comprising:
a color filter on a substrate; and
5 an organic photodiode disposed on the color filter,
wherein the organic photodiode includes:
an electrode insulating layer having a recess region on the substrate, the
recess region arranged on the color filter;
a first electrode on the color filter, the first electrode filling the recess region
10 of the electrode insulating layer;
a second electrode on the first electrode; and
an organic photoelectric conversion layer interposed between the first
electrode and the second electrode,
wherein the first electrode has an upper surface facing the organic photoelectric
15 conversion layer and a lower surface opposite to the upper surface, and the upper surface is
larger than the lower surface, and
wherein the first electrode includes a seam extending at a first angle from a side
surface of the recess region of the electrode insulating layer.
- 20 2. The image sensor of claim 1,
wherein the first electrode is discontinuous across the seam.
3. The image sensor of claim 1 or claim 2,
wherein the substrate includes:
25 a photodiode disposed under the color filter; and
a storage node region electrically connected to the photodiode.
4. The image sensor of claim 3, further comprising:
an upper insulating layer surrounding a side surface of the color filter; and
30 an upper contact plug penetrating the upper insulating layer to be in contact with the
first electrode.

5. The image sensor of claim 4, further comprising:
a contact via penetrating the substrate to be in contact with the upper contact plug;
and
a lower contact plug protruding into the contact via.

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6. The image sensor of claim 5, further comprising:
an interlayer insulating layer having an interconnection layer,
wherein the lower contact plug is electrically connected to the storage node region
through the interlayer insulating layer.

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7. The image sensor of any one of claims 1 to 6,
wherein the seam of the first electrode extends from a corner of the recess region of
the electrode insulating layer toward the upper surface of the first electrode.

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8. The image sensor of claim 7,
wherein the seam is connected to the upper surface of the first electrode.

9. The image sensor of claim 7 or claim 8,
wherein the seam is connected to the corner of the recess region of the electrode
insulating layer.

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10. The image sensor of any one of claims 1 to 9,
wherein the first electrode further includes a first region and a second region divided
by the seam, and

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wherein the first region is disposed between the seam and a lower surface of the
recess region of the electrode insulating layer, and

wherein the second region is disposed between the seam and a side surface of the
recess region of the electrode insulating layer.

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11. The image sensor of claim 10,
wherein the first region and the second region are formed of a same material.

12. The image sensor of claim 11,
wherein the first region includes a poly-crystalline phase.
13. The image sensor of claim 12,
5 wherein the first region further includes an amorphous phase.
14. The image sensor of any one of claims 1 to 10,
wherein the first electrode further includes a first region and a second region divided
by the seam, and
10 wherein the first region has a decreasing width toward the organic photoelectric
conversion layer, and
wherein the second region has an increasing width toward the organic photoelectric
conversion layer.
- 15 15. The image sensor of any one of claims 1 to 14, further comprising:
a capping insulating layer interposed between the color filter and the first electrode.
16. The image sensor of claim 15,
wherein the recess region of the electrode insulating layer exposes the capping
20 insulating layer.
17. The image sensor of any one of previous claims 1 to 16,
wherein the electrode insulating layer surrounds a side surface of the first electrode.
- 25 18. The image sensor of any one of previous claims 1 to 17,
wherein the first electrode has an increasing width from a lower surface of the recess
region toward the organic photoelectric conversion layer.
19. An image sensor, comprising:
30 a first electrode on a substrate;
an electrode insulating layer surrounding a side surface of the first electrode;
a second electrode on the first electrode; and

an organic photoelectric conversion layer interposed between the first electrode and the second electrode,

wherein the first electrode has an upper surface facing the organic photoelectric conversion layer and a lower surface opposite to the upper surface, and the upper surface is

5 larger than the lower surface,

wherein the first electrode includes a first region, a second region and a seam, the seam dividing the first electrode into the first region and the second region,

wherein the first region and the second region are discontinuous across the seam,

wherein the first region has a decreasing width toward the organic photoelectric

10 conversion layer, and

wherein the second region has an increasing width toward the organic photoelectric conversion layer.

20. The image sensor of claim 19,

15 wherein the first electrode includes ITO, ZnO, SnO₂, TiO₂, ZITO, IZO, GIO, ZTO, FTO, AZO, or GZO.