SOLAR CELL, METHOD FOR MANUFACTURING DOPANT LAYER, AND METHOD FOR MANUFACTURING SOLAR CELL

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of Korean Patent Application No. 10-2012-0050314, filed on May 11, 2012 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE DISCLOSURE

1. Field of the Disclosure

The disclosure relates to a solar cell, a method for manufacturing a dopant layer, and a method for manufacturing a solar cell. More particularly, the disclosure relates to a solar cell including a dopant layer, and a method for manufacturing the dopant layer and a method for manufacturing a solar cell including the same.

2. Description of the Related Art

Recently, as existing energy resources such as oil or coal are expected to be exhausted, an interest in alternative energy for replacing oil or coal is increasing. In particular, a solar cell that directly converts or transforms solar energy into electricity using a semiconductor element is gaining attention.

In a solar cell, a p-n junction is formed by forming a dopant layer in order to induce photoelectric conversion, and an electrode electrically connected to the dopant layer is formed. When a doping amount increases so that the doping layer can have a sufficient thickness, surface recombination of electrons and holes at the dopant layer may increase. Thus, it is difficult to increase a thickness of the dopant layer and reduce the surface recombination at the same time.

SUMMARY

Embodiments of the invention is directed to provide a method for manufacturing a dopant layer being able to have a sufficient thickness and to prevent surface recombination of electrons and holes, and to provide a method for manufacturing a solar cell including the dopant layer.

Also, embodiments of the invention is directed to provide a solar cell including a dopant layer being able to have a sufficient thickness and to prevent surface recombination of electrons and holes.

In a method of manufacturing a solar cell according to an embodiment of the invention, a dopant layer is formed by doping a dopant of a first conductive type and a counter dopant of a second conductive type opposite to the first conductive type to a surface of a semiconductor substrate. Here, a doping amount of the counter dopant is less than a doping amount of the dopant.

A solar cell according to an embodiment includes: a semiconductor substrate; a dopant layer formed at a surface of the semiconductor substrate; and an electrode electrically connected to the dopant layer. Here, the dopant layer includes a dopant of a first conductive type and a counter dopant of a second conductive type opposite to the first conductive type. Also, a doping concentration of the counter dopant is less than a doping concentration of the dopant.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross-sectional view of a solar cell according to an embodiment of the invention.

FIG. **2** is a plan view schematically illustrating a first electrode of the solar cell shown in FIG. **1**.

FIGS. **3***a* to **3***g* are cross-sectional views for illustrating a method for manufacturing a solar cell according to an embodiment of the invention.

FIG. **4** is a cross-sectional view of a solar cell according to another embodiment of the invention.

FIG. **5** is a cross-sectional view of a solar cell according to yet another embodiment of the invention.

FIG. **6** is a plan view schematically illustrating a relation of a first electrode and an emitter layer of the solar cell shown in FIG. **5**.

FIG. **7** is a graph illustrating leakage current (Joe) of solar cells manufactured by Experimental Embodiments 1 to 6 and Comparative Example.

FIG. **8** is a graph illustrating carrier lifetime of solar cells manufactured by Experimental Embodiments 1 to 6 and Comparative Example.

FIG. **9** is a graph illustrating open circuit voltage of solar cells manufactured by Experimental Embodiments 1 to 6 and Comparative Example.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Hereinafter, embodiments of the invention will be described with reference to the accompanying drawings. However, the invention is not limited the embodiments, and the various modifications of the embodiments are possible.

In order to clearly and concisely illustrate the embodiments of the invention, elements not related to the invention may be omitted in the figures. Also, elements similar to or the same as each other may have the same reference numerals. In addition, the dimensions of layers and regions may be exaggerated or schematically illustrated, or some layers may be omitted for clarity of illustration. In addition, the dimension of each part as drawn may not reflect an actual size.

In the following description, when a layer or substrate "includes" another layer or portion, it can be understood that the layer or substrate further includes still another layer or portion. Also, when a layer or film is referred to as being "on" another layer or substrate, it can be understood that the layer of film is directly on the other layer or substrate, or intervening layers are also be present. Further, when a layer or film is referred to as being "directly on" another layer or substrate, it can be understood that the layer or film is directly on the another layer or substrate, and thus, there is no intervening layer.

Hereinafter, a method for manufacturing a dopant layer and a method for a solar cell including the same, and a solar cell manufactured by the method for manufacturing the solar cell according to embodiments of the invention will be described with reference to the accompanying drawings.

FIG. **1** is a cross-sectional view of a solar cell according to an embodiment of the invention, and FIG. **2** is a plan view schematically illustrating a first electrode of the solar cell shown in FIG. **1**.

Referring to FIGS. **1** and **2**, a solar cell **100** according to the embodiment includes a semiconductor substrate **10**, dopant layers **20** and **30** formed at the semiconductor substrate **10**, and electrodes **24** and **34** electrically connected to the semiconductor substrate **10** or the dopant layers **20** and **30**. More specifically, the dopant layer **20** and **30** may include a first dopant layer (hereinafter, referred to as "an emitter layer") **20** formed at or adjacent to a first surface (hereinafter, referred to as "a front surface") of the semiconductor substrate **10**, and a second dopant layer (hereinafter, referred to as "a back sur-