SUMMARY OF THE INVENTION

Embodiments of ~~T~~the present invention ~~has~~have been made in consideration of the above-mentioned circumstances. Accordingly, ~~it is an~~embodiments ~~object~~ of the present invention seek to provide a method of manufacturing a solar cell by which an adequate passivation effect and a high photoelectric conversion efficiency can be obtained without increasing the number of manufacturing steps, and a solar cell manufactured by the solar cell manufacturing method.

In order to enhance the photoelectric conversion efficiency of crystalline silicon solar cells, passivation (inactivation) of surfaces on the face and back sides of a substrate is important. A passivation film for a solar cell substrate may be, for example, an SiNx film, an SiO_2 film, an aluminum oxide film or the like. Among these exemplary passivation films, the SiNx film is excellent in passivation properties for n-type semiconductors. The reason is considered to lie in that the SiNx film is positively charged.

Therefore, while a p-type diffusion layer is formed on the light-receiving surface side of a semiconductor substrate in the case where the semiconductor substrate is of the n type, formation thereon of an SiNx film like the passivation film 105 in FIG. 1 would not result in that the SiNx film functions sufficiently as a passivation film for the p-type diffusion layer.

On the other hand, an SiO_2 film and an aluminum oxide film are said to be effective in achieving passivation of p-type semiconductors.

Based on these findings, the present inventors made extensive and intensive investigations and, as a result, have made the present invention as follows.

Particularly, in order to attain the above object, according to a first aspect of the present invention, there is provided a

method of manufacturing a solar cell, comprising steps of:

(i) forming an SiNx film over a back surface of an n-type semiconductor substrate;

(ii) forming a texture on a light-receiving surface of the n-type semiconductor substrate by immersion of the substrate in a heated alkali solution;

(iii)forming a p-type diffusion layer over the light-receiving surface of the n-type semiconductor substrate; and

(iv) forming over the p-type diffusion layer a passivation film composed of an SiO_2 film by a thermal oxidation method or an aluminum oxide film by an atomic layer deposition method,

wherein the SiNx film serves as a treatment mask during the texture formation in step (ii), and as an oxidation mask during the formation of the SiO_2 film or the aluminum oxide film in step (iv).

According to a second aspect of the present invention, there is provided a method of manufacturing a solar cell, comprising steps of:

(i) forming an n-type diffusion layer over a back surface of a p-type semiconductor substrate;

(ii) forming an SiNx film over the n-type diffusion layer;

(iii) forming a texture on a light-receiving surface of the p-type semiconductor substrate by immersion of the substrate in a heated alkali solution; and

(iv) forming over the light-receiving surface of the p-type semiconductor substrate a passivation film composed of an SiO_2 film by a thermal oxidation method or an aluminum oxide film by an atomic layer deposition method,

wherein the SiNx film serves as a treatment mask during the texture formation in step (iii), and as an oxidation mask during the formation of the SiO_2 film or the aluminum oxide film in step (iv).

Embodiments of the present invention provide a