backside of the solar cell. The contact fingers allow an external electrical circuit to be coupled to and be powered by the solar cell.

Efficiency is an important characteristic of a solar cell as it is directly related to the solar cell's capability to generate power. Accordingly, techniques for increasing the efficiency of solar cells are generally desirable. The present invention allows for increased solar cell efficiency by providing processes for fabricating novel solar cell structures.

SUMMARY

According to a first aspect of the invention, a solar cell structure is provided. The solar cell structure comprises a doped silicon substrate having a front side configured to face the sun during normal operation and a backside opposite the front side; a P-type doped region and an N-type doped region, the P-type and N-type doped regions comprising polysilicon; a first dielectric layer over the substrate and underneath each of the P-type doped region and the N-type doped region; a trench separating and electrically isolating the P-type doped region from the N-type doped region; and a second dielectric layer formed in the trench.

According to a second aspect of the invention, a method of fabricating a solar cell is provided. The method comprises forming a first dielectric layer on a doped solar cell substrate; forming a P-type doped region and an N-type doped region on a backside of the doped solar cell substrate, the P-type and N-type doped regions being over the first dielectric layer, the backside being opposite a front side of the solar cell that faces the sun during normal operation, the doped

substrate comprising an N-type silicon wafer; forming a trench separating and electrically isolating the P-type doped region and the N-type doped region; and depositing a second dielectric layer in the trench.

According to a third aspect of the invention, a solar cell structure includes a P-type doped region and an N-type doped region formed on a backside of a doped silicon substrate, the P-type doped region and the N-type doped region comprising polysilicon, each of the P-type and N-type doped regions being formed over a dielectric layer; and a trench structure separating and electrically isolating the P-type doped region and the N-type doped region.

In one embodiment, a solar cell includes polysilicon P-type and N-type doped regions on a backside of a substrate, such as a silicon wafer. A trench structure separates the P-type doped region from the N-type doped region. Each of the P-type and N-type doped regions may be formed over a thin dielectric layer. The trench structure may include a textured surface for increased solar radiation collection. Among other advantages, the resulting structure increases efficiency by providing isolation between adjacent P-type and N-type doped regions, thereby preventing recombination in a space charge region where the doped regions would have touched.

These and other features of the present invention will be readily apparent to persons of ordinary skill in the art upon reading the entirety of this disclosure, which includes the accompanying drawings and claims.

DESCRIPTION OF THE DRAWINGS