Chapter 6

THE EFFECT OF DEFECTS ON THE SILICON SOLAR CELL

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Introduction

In the silicon crystal used in photovoltaic applications, it contains various point defects such as gap, pollution, intermediates, dislocations, grain boundaries, micro defects, mass defects. From defects to point defects, dislocations, grain boundaries and mass disturbances have a great impact on the devices. Spot defects are usually seen in single crystal cells. Mc-Si dislocates the greatest effect on performance in solar cells and affects other defects such as grain boundaries and impurities, respectively. These defects are used to determine the electrical and optical properties of the material. Pollution defect affects the electrical performance of the material in the raw material or during crystal growth and shortens the life of the minority carrier(1-2). Pollution atoms are found in dislocations and grain boundaries. Dislocations during crystal growth form atoms of impurity. The relationship between dislocations and pollution atoms affects many properties of the semiconductor(3). There are two important considerations in the production of low-cost Mc-Si solar cells. These are electrical loss due to recombination defects and breakage of the thin plate due to residual tension. To determine the effect of these defects on the cell, the properties of the defects need to be known.

Decreased parameters are caused by increased recombinations. These faulty zones are shown as shunt. These shunts show the internal power distribution within the cell. Figure 1 (a) shows the efficiency of the defective and flawless solar cell. Figure 1 (b) shows the comparison of three similar cells(4). As can be seen from the figure is that the efficiency is proportional to the area covered by the crystal defects. As the effect of crystal defects decreases, the efficiency increases. Crystal

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in plates directly affects cell efficiency. Therefore, dislocation intensity should be closely monitored as the effect of crystal defects on cell efficiency. Dislocations are shown as the main cause of defects in materials. The presence of dislocations is a factor that directly affects cell efficiency. The efficiency of the cell varies with the intensity of the dislocation. The lower the dislocation density, the higher the efficiency. Where the dislocation density is high, the efficiency decreases as the leakage current increases. A variety of methods are employed to minimize dislocation intensity. Since dislocations act as electronically active centers, dislocation motion is used to alter the electronic properties of the structure. Dislocations form a positive space charge region by capturing free electrons in n-type crystals and a negative space charge region by capturing holes in p-type crystals. This shortens the life of the minority carrier and causes loss. The effects of dislocations on large area solar cell devices affect its performance. As a result, defects in crystal materials appear to be undesirable, but are an advantage for properties such as optimization of materials and improving performance efficiency. Therefore, device and solar cells can be made according to the crystal structure and defect type of the material. A detailed examination of the properties of these structures will lead to the sub-steps of the new materials and devices to be produced and innovative and high performance materials will be produced.

Keywords: Silicon crystals, Silicon solar cell, Dislocation.

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