課題番号 :F-17-TT-0027
利用形態 :技術代行
利用課題名(日本語) :次世代太陽電池技術開発
Program Title (English) :Development of Next Generation Solar Cell Technology
利用者名(日本語) :磯貝勇樹
Username(English) :U. Isogai
所属名(日本語) :豊田工業大学大学院先端工学研究科
Affiliation (English) :Department of Advanced Science and Technology, Graduate School of Engineering, Toyota Technological Institute
キーワード／Keyword :リソグラフィ・露光・描画装置、太陽電池、反射防止、V形グルーブ

1. 概要(Summary)

Improving the utilization ratio of sunlight is a key factor for the development of high efficiency silicon solar cells. Texturing has an effect of reducing reflection losses and improves the light trapping capabilities of the silicon (Si) solar cell. Therefore, texturing is one of the most important steps in the solar cell fabrication process. In the Si photovoltaic industry, conventional upright random pyramid texturing has been applied for the fabrication of conventional Si solar cells based on mono-crystalline Si wafers. Recently, V-groove texturing has been known that it can provide advantages over the conventional upright random pyramid texturing used in the Si photovoltaic industry [1]. In this study V-groove texturing of n-type (100) Si wafers was studied for improving the performance of highly-doped p-type emitters and the efficiency of the n-type Si solar cells.

2. 実験(Experimental)

【利用した主な装置】　マスクレス露光装置、マスクアライナ装置、Reactive Ion Etching 装置(非 Bosch プロセス)、デジタルマイクロスコープ群、エリプソメーター

【実験方法】

The fabrication of the V-groove textured surfaces was achieved by one photomasking step-that used to define the silicon dioxide V-groove etching mask. Formation of the p+ emitters was achieved by deposition of atmospheric pressure chemical vapor deposition (APCVD) BSG layers and SiO_x capping layers followed by high temperature diffusion in an industrial tube furnace. Morphology and boron diffusion were investigated by SEM.

3. 結果と考察(Results and Discussion)

Samples with about 2, 4, and 6 μm height and about 2.5, 5.0, and 7.5 μm pitch V-groove surface textures could be fabricated on (100) Si surfaces, respectively. Fig. 1 (a) and (b) show photos of the fabricated V-groove textured samples and Fig. 1(c) shows a SEM image of a sample with an about 4 μm height and 5.0 μm pitch V-groove pattern. From the SEM analysis we can confirm the formation of V-groove surface textures well.

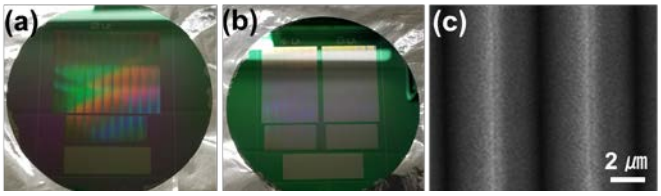

Fig. 1 Photos of (a) a sample with about 2 μm height and 2.5 μm pitch V-groove surface texture and (b) a sample with about 4 and 6 μm height and 5.0 and 7.5 μm pitch V-groove surface textures, respectively. (c) A SEM image of the sample with an about 4 μm height and 5.0 μm pitch V-groove pattern.

Highly doped p-type emitters have been formed on these samples (data not shown), and effects of the different V-groove on the Si solar cell performance will be investigated further.

4. その他・特記事項(Others)

[1] N. Borojevic et al., Phys. Status Solidi A, **211**, (2014) 1617.

5. 論文・学会発表(Publication/Presentation)

なし。

6. 関連特許(Patent)

なし。