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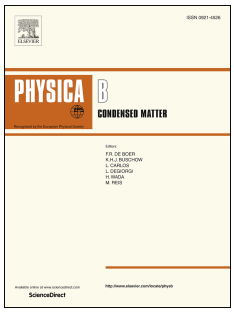

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Growth of KOH etched AZO nanorods and investigation of its back scattering effect in thin film a-Si solar cell

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Abstract: In order to increase the stabilized efficiencies of thin film silicon (TFS) solar cells it is necessary to use better light management techniques. Texturization by etching of sputtered aluminum doped zinc oxide (Al:ZnO or AZO) films has opened up a variety of promises to optimize light trapping schemes. RF sputtered AZO film has been etched by potassium hydroxide (KOH). A systematic study of etching conditions such as etchant concentration, etching time, temperature management etc. have been performed in search of improved electrical and optical performances of the films. The change in etching conditions has exhibited a noticeable effect on the structure of AZO films for which the light trapping effect differs. After optimizing the etching conditions, nanorods have been found on the substrate. Hence, nanorods have been developed only by chemical etching, rather than the conventional development method (hydrothermal method, sol-gel method, electrolysis method etc.). The optimized etched substrate has 82% transmittance, moderate haze in the visible range and sheet resistance ~13 (Ω/□). The developed nanorods (optimized etched substrate) provide better light trapping within the cell as the optical path length has been increased by using the nanorods. This provides an effect on carrier collection as well as the efficiency in a-Si solar cells. Finite difference time domain (FDTD) simulations have been performed to observe the light trapping by AZO nanorods formed on sputtered AZO films. For a p-i-n solar cell developed on AZO nanorods coated with sputtered AZO films, it has been found through simulations that, the incident light is back scattered into the absorbing layer, leading to an increase in photogenerated current and hence higher efficiency. It has been found that, the light that passes through the nanorods is not getting absorbed and maximum amount of light is back scattered towards the solar cell.

Keywords: Nanorods; Light trapping; FDTD; Solar cell

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