

Fabrication Techniques for Light Trapping and Capturing Textures in Crystalline Silicon Solar Cells

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Abstract – In order to increase the performance/cost ratio of solar cells, new approaches reducing optical and electrical losses are necessary during the absorption of the light and collection of charge carriers. In this work we focused on various textures on Si surface towards a better light management of the cell surface. The efficiency of a solar cell strongly depends on the properties of the interaction between the incoming light beam and the surface of the device. In order to maximize the absorption and the efficiency of the cell, various light trapping schemes have been proposed. We have applied different lithography techniques such as optical lithography, nanoimprint lithography (NIL), hole mask colloidal lithography (HCL) to generate various periodic micro and nano surface textures. After predefined pattern transfer process steps, either dry plasma etching or wet chemical etching techniques were applied. Structural properties of the features like diameter, pitch size, depth were varied and optimized. With a variety of texturing and etching process types, at the end of the study, periodic and random-introduced-periodic patterns were successfully implemented to solar cell fabrication step. The performances of the solar cells were investigated both optically and electrically.

Keywords – solar cells, surface texturing, light trapping, micro electro mechanical systems, crystalline silicon