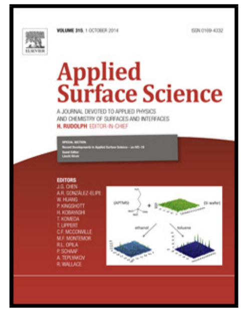


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# Laser Induced Forward Transfer for front contact improvement in Silicon Heterojunction Solar Cells

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**Abstract**

In this work the Laser Induced Forward Transfer (LIFT) technique is investigated to create n-doped regions on p-type c-Si substrates. The precursor source of LIFT consisted in a phosphorous-doped hydrogenated amorphous silicon layer grown by Plasma Enhanced Chemical Vapor Deposition (PECVD) onto a transparent substrate. Transfer of the doping atoms occurs when a sequence of laser pulses impinging onto the doped layer propels the material towards the substrate. The laser irradiation not only transfers the doping material but also produces a local heating that promotes its diffusion into the substrate. The laser employed was a 1064 nm, lamp-pumped system, working at pulse durations of 100 and 400 ns. In order to obtain a good electrical performance a comprehensive optimization of the applied laser fluency and number of pulses was carried out. Subsequently, arrays of n+p local junctions were created by LIFT and the resulting J-V curves demonstrated the formation of good quality n+ regions. These structures were finally incorporated to enhance the front contact in conventional silicon heterojunction solar cells leading to an improvement of conversion efficiency.

***Keywords:*** LIFT, silicon heterojunction solar cell, laser direct-write

## 1. Introduction

Potential applications of Laser Induced Forward Transfer (LIFT) are being extensively explored by the scientific community in the last years [1,2]. In this period, theoretical and practical analysis have contributed to the understanding of the physical phenomena behind the LIFT process[1]. Additionally, more fields of applications are being proposed for deposition of materials via LIFT. In particular, photovoltaic technology seems to be a potential candidate that might take advantage of the LIFT technology for the deposition of a large variety of materials of both inorganic and organic nature [4-6]. In general, direct write (DW) techniques exhibit the advantage of avoiding the use of photolithography steps and of serigraphy masks, thus making these techniques a suitable and flexible alternative when different types of patterns and structures need to be defined [2]. Thus, being LIFT among said DW techniques, it can take advantage not only of this previous described property but also of the variety of substrates that can be used when selecting the right laser characteristics (especially, wavelength and pulse duration).

Among solar cells based on silicon technology, heterojunction (HT) cells present a potential solution to reduce the expenses associated with the use of relatively thick silicon wafers. Indeed, the amorphous silicon layers in HT cells can be deposited in thinner wafers which could result in a significant decrease of the amount of crystalline silicon to be employed in the final device. In this scenario, the most remarkable category of HT solar cells with already demonstrated higher efficiency corresponds to the HIT (Heterojunction with Intrinsic Thin-film) technology.