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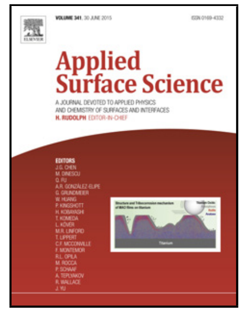

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Investigation of laser-fired point contacts on KOH structured laser-crystallized silicon by conductive atomic force microscopy

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Abstract
A conductive atomic force microscope is used to study the local topography and conductivity of laser-fired aluminum contacts on KOH-structured multicrystalline silicon surfaces. A significant increase in conductivity is observed in the laser-affected area. The area size and spatial uniformity of this enhanced conductivity depends on the laser energy fluence. The laser-affected area shows three ring-shaped regimes of different conductance depending on the local aluminum and oxygen concentration. Finally, it was found that the topographic surface structure determined by the silicon grain orientation does not significantly affect the laser-firing process.

Keywords
Liquid phase crystallization, Multicrystalline silicon, Laser firing, Point-contact scheme, Atomic force microscopy

1. Introduction

Laser processing is a common technique in modern photovoltaic industry [1]. The range of application starts with the selective local removal of material for layer structuring purposes in thin-film photovoltaics [2,3] and extends to wafer-based technologies as a silicon homo- and heterojunction solar cells [4,5]. Recently, an all-by-laser point-contact scheme for liquid-phase-crystallized silicon on glass was reported [6]. At the same time, the laser-fired contacts (LFC) technique was successfully demonstrated to stabilize the thin-film silicon solar cell efficiency by an optimization of the rear-side point contact scheme [7]. Besides the reported macroscopic improvement in contact resistance, recombination activity, and stability, the microscopic details of the LFC technique are still to be investigated in order to analyze the optimal process conditions.

In this study, conductive atomic force microscopy (c-AFM) will be employed to gain information on the spatial distribution of the electrical conductance within the laser-affected area. In addition, energy dispersive X-ray (EDX) spectroscopy is performed to reveal the chemical composition within the LFC region. Thereby, the influence of the surface texture as well as the laser intensity on the resulting LFC will be investigated.