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PECVD OF SILICON THIN FILMS WITH AND WITHOUT DUST FORMATION

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Hydrogenated microcrystalline (μc-Si:H) and amorphous (a-Si:H) silicon thin films have attracted particular attention in the last decades due to their properties and their application in thin film solar cells and optoelectronic devices. Plasma Enhanced Chemical Vapor Deposition (PECVD), is the most common technique which is used worldwide. Microcrystalline and amorphous silicon thin films were deposited here using radio frequency (RF), capacitively coupled silane/hydrogen (SiH_4/H_2) discharges. Dust formation is common drawback of such type of discharges which in turn affects the properties of the films and their suitability for solar cells and optoelectronic devices.
Different techniques have been proposed to suppress the generation and the growth of harmful particles. In this work, we deposited silicon films in conditions with and without dust particles. The experiments were performed under Continuous Wave (CW) and Pulsed Plasma generation in order to control particles and dust formation. Different time-resolved plasma diagnostics, such as Optical Emission Spectroscopy (OES) and self-bias voltage (V_{dc}), were used for the detection of particle formation. Mass spectrometry was also used in order to estimate higher silanes formation during the deposition.
The deposited films were characterized in terms of crystallinity, hydrogen content and optical properties by Laser Raman Spectroscopy, Fourier Transformed Infrared Spectroscopy (FTIR) and UV/Vis spectroscopy, respectively. Finally, Atomic Force Microscopy (AFM) was applied to monitor the morphology and roughness of the films. The properties and the morphology of the deposited films are compared in order to determine the effect of the dust particles on the material's quality.

Keywords
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