Effects of doping on structural change and hydrogen bonding in laser crystallized polycrystalline silicon films

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Abstract

Doped polycrystalline silicon films were produced by employing a step-by-step laser crystallization of doped hydrogenated amorphous silicon (a-Si:H). The influence of laser crystallization on structural properties and hydrogen bonding were investigated using Raman backscattering spectroscopy and hydrogen effusion measurements. Crystallization with low laser fluence, $E_L$, results a stratified structure with polycrystalline silicon layer at the top of an amorphous layer. In fully crystallized polycrystalline silicon the Raman lines in both P- and B-doped specimens are asymmetric, which is indicative of the Fano effect. From the hydrogen effusion spectra, the hydrogen density-of-states distribution is derived. Laser crystallization results in an increase of the hydrogen binding energy by about 0.2–0.3 eV compared to the amorphous starting material.

Keywords: Doped polycrystalline silicon; Laser crystallization; Raman spectroscopy; Hydrogen effusion; Hydrogen bonding; Hydrogen density-of-states

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