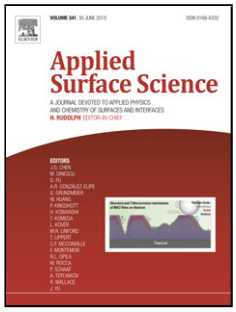

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Author: P. Novák J. Očenášek L. Prušáková V. Vavruňková J. Savková J. Rezek

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Influence of heat generated by a Raman excitation laser on the structural analysis of thin amorphous silicon film

P. Novák[1], J. Očenášek[1], L. Prušáková[1], V. Vavruňková[1], J. Savková[1], J. Rezek[2]

[1]New Technologies - Research Centre, University of West Bohemia, 30614 Plzeň , Czech Republic

[2]Department of Physics and NTIS - European Centre of Excellence, University of West Bohemia, 30614 Plzeň, Czech Republic

Abstract

In the present work we investigate thin amorphous silicon film fabricated by plasma enhanced chemical vapor deposition. In particular, we analyze changes in the recorded Raman spectra caused by excitation laser irradiation. Solid phase crystallization, hydrogen diffusive outflow and Raman spectra peak shifts have been observed experimentally and analyzed numerically. The role of film thickness on all these features is pointed out. The study involves laser powers between 0.1mW and 10mW focused to a spot diameter of ~1μm and film thicknesses between 50 and ~2000 nm. Additionally, the laser induced temperature fields were analyzed by means of numerical simulation and the Raman spectral shift trough Balkanski model. Results are correlated to structural analysis by Raman spectroscopy, optical microscopy, scanning electron microscopy and atomic force microscopy. It was found that the hydrogen content and solid phase fraction identified by Raman spectroscopy are highly sensitive to the applied excitation laser power.

Keywords

Hydrogenated amorphous silicon, Raman spectroscopy, structure, PECVD, thermal field