

## Comparison of the effects of environmental treatments on hydrogen concentration and energy gap variations of hydrogenated amorphous and polymorphous silicon films prepared by PECVD technique

© Alireza Keramatzadeh, Abdolnabi Kosarian<sup>✉</sup>, Hooman Kaabi

Faculty of Engineering, Shahid Chamran University of Ahvaz,  
Ahvaz, Iran

<sup>✉</sup> E-mail: a.kosarian@scu.ac.ir, a-keramatzadeh@phdstu.scu.ac.ir, h.kaabi@scu.ac.ir

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Hydrogen to silicon (Si-H) bond concentration and strength play important roles in high quality hydrogenated amorphous silicon layers prepared by PECVD techniques. In this paper, a number of amorphous and polymorphous Si layers have been deposited at different plasma conditions where a wide range of hydrogen concentration in the films are obtained. Some of the samples were stored in free air and the others in nitrogen for eight days. The layers were analyzed using AFM, FTIR, Raman, UV-Visible, and TEM immediately after deposition and after treatments. The results indicate that in the amorphous films with appreciable amount of embedded silicon nanocrystals, the variation of hydrogen content behaves differently than that of the amorphous films. It has been observed that treatment in the air increases the energy gap of the nanocrystals surrounded by oxide shells, formed around the surface nanocrystals, due to the quantum confinement effects.

**Keywords:** hydrogen content, nanocrystal embedded, polymorphous silicon, amorphous film.

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