

**Improving the light-induced degradation of hydrogenated amorphous silicon solar cells
using fabrication at elevated temperatures and low pressure**

by

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ABSTRACT

A method of fabricating hydrogenated amorphous silicon (a-Si:H) solar cells that reduces light-induced degradation via the Staebler-Wronski effect is presented. By using elevated temperatures up to 450°C with chamber pressures down to 25mT, a-Si:H solar cells are fabricated with improved stabilities. This combination of fabrication conditions, combined with a gradient of boron doping (ppm) in the intrinsic layer creates solar cells with a measured degradation of only 10% compared to almost 25% for standard devices. Defect density measurements before and after light exposure confirm that midgap trap states are not changed as much as in standard devices. This indicates less light-induced defects are created which ultimately reduce solar cell efficiency.

All samples were fabricated and measured at the Microelectronics Research Center at Iowa State University. Devices were made using a single chamber plasma-enhanced chemical vapor deposition (PECVD) reactor operating at 45MHz. Standard measurements included current versus voltage, external quantum efficiency, capacitance spectroscopy, and subgap quantum efficiency.

Light degradation testing was performed using a custom setup that was designed and built at the MRC. The light soaking apparatus allows for automated, in-situ measurements of samples while being exposed to simulated sunlight (AM1.5) for variable amounts of time and intensity.

The method of fabrication that is ultimately presented was arrived upon after systematically studying devices with other fabrication parameters. These results are also given to show the logical progression of attempts and the eventual outcome.