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수소화된 실리콘 박막 태양전지 및 모듈 개발
Developments of hydrogenated Si-based thin film solar cell & module

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Hydrogenated amorphous silicon (a-Si:H)-based thin film solar cells have been considered as one of the most promising thin film solar cells, and expected to reduce the PV cost.

Recently, we have developed *p-i-n* a-Si:H single junction thin film solar cells by newly installed RF (13.56MHz) or VHF(40.68MHz) plasma enhanced chemical vapor deposition (PECVD) systems, and also successfully fabricated the mini-modules (>300cm^2) using the laser patterning technique to form an integrated series connection. The efficiency of a mini-module was 7.4% (Area=305cm^2, Isc=0.25A, Voc=14.74V, FF=62%). To fabricate large area modules, it is important to optimise the integrated series connection, without damaging the cell. We have newly installed the laser patterning equipment that consists of two different lasers, SHG-YVO4 (=0.532m) and YAG (=1.064m). The mini-modules are formed through several scribed lines such as pattern-1 (front TCO), pattern-2 (PV layers) and pattern-3 (BR/back contact). However, in the case of pattern-3, a high-energy part of laser shot damaged the textured surface of the front TCO, so that the resistance between the each cells decreases due to an incomplete isolation.

In this study, the re-deposition of SnOx from the front TCO, Zn (BR layer) and Al (back contact) on the sidewalls of pattern-3 scribed lines was observed. Moreover, re-crystallization of a-Si:H layers due to thermal damage by laser patterning was evaluated. These cause an increase of a leakage current, result in a low efficiency of module. To optimize a-Si:H single junction thin film modules, a laser beam profile was changed, and its effect on isolation of scribed lines is discussed in this paper. In addition, in the conference, we will discuss the internal bonding structure of i-a-Si films in more details to obtain a highly stabilized a-Si:H film, and report the best performance of a stabilized a-Si:H single junction solar cells after light soaking.