2007년도 한국표면공학회 춘계학술대회 논문집

# R&D activities of a-Si:H thin film solar cells by LG Electronics

이돈희
LG전자기술원 소자재료연구소

**Abstract** : Recently, we have developed *p*-i-*n* hydrogenated amorphous silicon (a-Si:H) single junction (SJ) thin film solar cells with RF (13.56MHz) plasma enhanced chemical vapor deposition (PECVD) systems, and also successfully fabricated the mini-modules (>300cm$^2$), using laser scribing technique to form an integrated series connection. The efficiency of a mini-module was 7.4% (Area=305cm$^2$, $I_{SC}$=0.25A, $V_{OC}$=14.74V, *FF*=62%).

## 1. a-Si:H-based thin film solar cells

The amorphous Si-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. We have recently developed a-Si:H single junction solar cells by newly installed RF(13.56MHz) or VHF(40.68MHz) plasma enhanced chemical vapor deposition (PECVD) systems (Fig. 1). In a cluster type multi-chamber deposition system, *p*-i-*n* a-Si:H single junction thin film solar cells were deposited on glass/TCO ($SnO_2$) substrates. The back reflector (BR) layer (ZnO, T=50nm) and back contact (Al=300nm) were deposited by sputtering method, respectively.

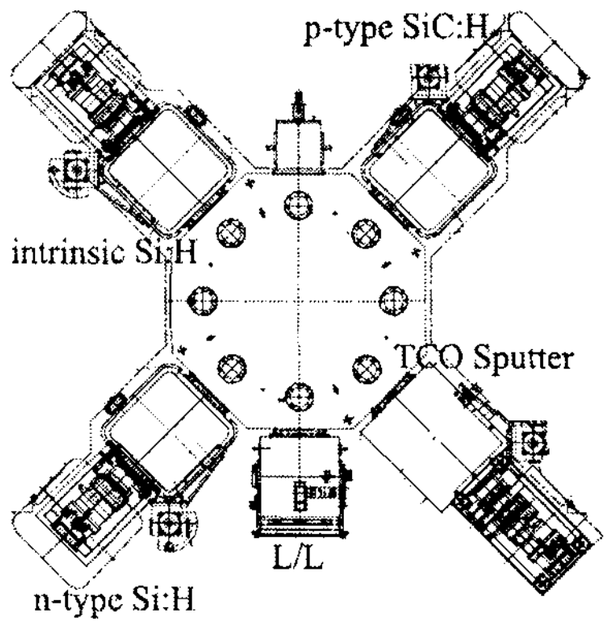


Fig. 1. System layout of newly installed pulsed PECVD.

The typical solar cell structure of present study is glass/TCO($SnO_2$)/(p-a-SiC:H/i-a-Si:H/n-a-Si:H)/TCO (ZnO)/Metal (Al), as seen in Fig. 2.

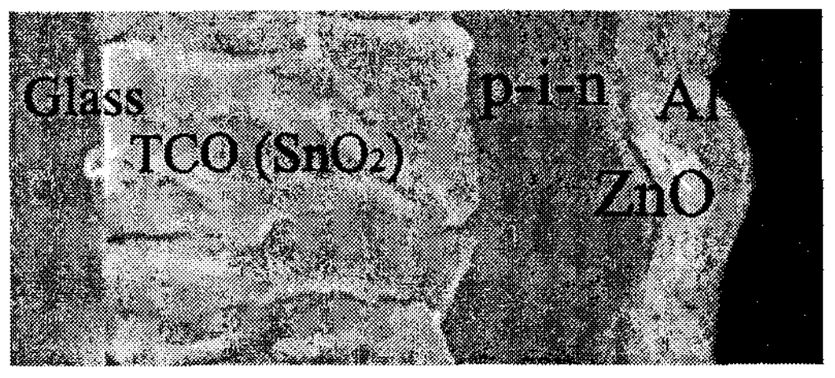


Fig. 2. Microstructure of a-Si:H solar cell.

We have attained successfully the conversion efficiency of 10.7% (A=0.09cm$^2$) with maximum open circuit voltage ($V_{OC}$) of 0.83 V, short circuit current density ($J_{SC}$) of 19.52 mA/cm2, and fill factor (*FF*) of 0.66.

## 2. Fabrication of mini-modules using laser scriber

We have developed large area thin film solar cell mini-modules (>300cm$^2$) as seen in Fig. 3(a), with the first step for the mass production, and optimized the integrated series connection to fabricate large area modules by laser scribing method, that allows a reduction of the cost for thin film solar cell module manufacturing. The efficiencies of a mini-module developed by us were 7.4% (A=305cm2, $I_{SC}$=0.25A, $V_{OC}$= 14.74V, *FF*=62%) measured with solar simulator under AM1.5G conditions, as seen in Fig. 3(b).

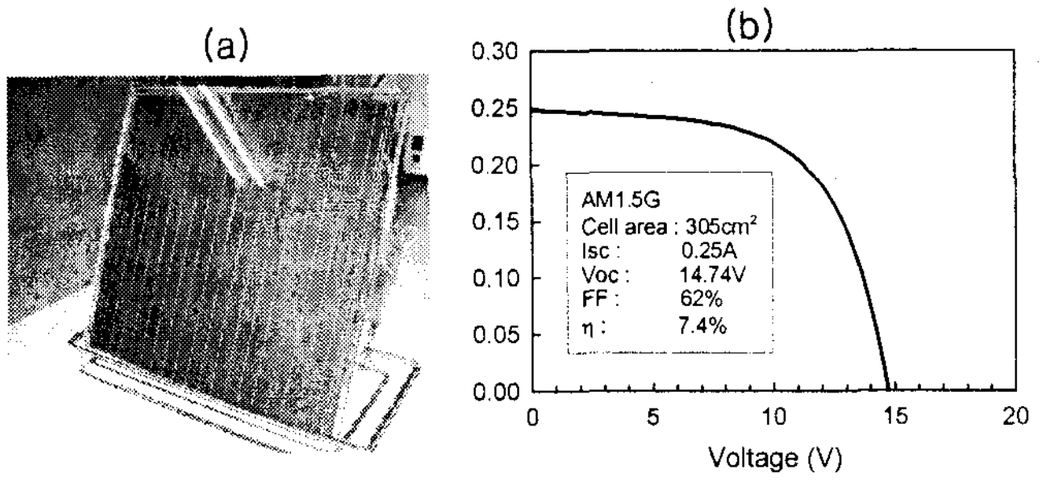


Fig. 3. Large area a-Si:H SJ mini-module (a) and I-V curve measured with solar simulator(AM1.5G) (b).

In the conference, we will discuss the fabrication of a-Si:H single junction solar cell and mini-module in more detail. In addition, the R&D plan of LGE and future prospects of thin film solar cell industry will be presented.