

# Study on the Properties of Hydrogenated Amorphous Silicon-Single Crystalline Silicon Heterojunctions

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Hydrogenated amorphous silicon (a-Si:H) single crystalline silicon (c-Si) heterojunctions were studied to investigate their opto-electrical properties and to apply them to imaging devices.

The internal photoemission for a-Si:H/c-Si heterojunctions showed that the conduction band and the valence band discontinuity were about 0.09 and 0.71 eV, respectively and thus that the band discontinuity was mainly at the valence band side.

The forward current at the low voltage was explained to be the tunneling current due to both the tunneling of electrons from c-Si to the gap states in a-Si:H being captured by these gap states. At high voltage it was explained to be the space-charge-limited current due to both electrons injected from c-Si and holes injected from the electrode.

The reverse current was influenced by the junction interface. For a-Si:H/c-Si with many interface defect states, the reverse current was considered to be mainly generated by the interface defect states. For the junctions with few interface defect states, the reverse current was lower and considered to be due to the generation current in the depletion layer of a-Si:H and c-Si.

To obtain high photosensitivity, the depletion layer must spread in both a-Si:H and c-Si. It was found that the minimization of the interface defect states was most important to get the junction which had the depletion layer spread in both a-Si:H and c-Si.

Finally, a-Si:H/c-Si heterojunctions were prepared using the mesh and applied to the vidicon targets without a diode array. The characteristics obtained were as follows: At the target voltage of 10 V and for an area of  $1 \text{ cm}^{-2}$ , the dark current and photosensitivity were 10 nA and 430 nA/lx, respectively and the resolution was more than 800 TV lines.