

# Development of environmental harmless thin film solar cell and novel structure of solar cell.



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<b>Keywords</b>	Environmental-friendly semiconductor, Solar cell, Photovoltaic generation		
<b>Technical Support Skills</b>	<ul style="list-style-type: none"> <li>• Development of <math>\text{Cu}_2\text{ZnSnS}_4</math>(CZTS) based thin film solar cells.</li> <li>• Preparation of thin film under several conditions.</li> <li>• Development of novel structure of solar cell, e.g.:ETA, 3D.</li> </ul>		

## Research Contents Fabrication of Three-Dimensional-Structure Solar Cell with $\text{Cu}_2\text{ZnSnS}_4$ .

$\text{Cu}_2\text{ZnSnS}_4$ (CZTS) is a low-cost, nontoxic, and abundant material, and has an optical band-gap energy of about 1.5eV and high absorption coefficient of over  $10^4\text{cm}^{-1}$ . The optical properties are suitable for the absorber layer of single-junction thin-film solar cells.

CZTS is, however, a quaternary compound, which adds another level of complexity and another set of harmful defects. Recombination at these defects is the observed in CZTS.

In order to reduce recombination, we adopt the three-dimensional (3D)-structure substrate. Figure 1 shows a schematic drawing of the 3D-structure solar cell. This structure will improve the conversion efficiency of the solar cell because it has the effect of not only decreasing the amount of recombination of carriers because of the smaller film thickness but also increasing the effective absorption length.

Therefore, we endeavor to fabricate a 3D-structure solar cell with CZTS by non-vacuum process. The CdS buffer layer in the solar cell was deposited by Chemical Bath Deposition.

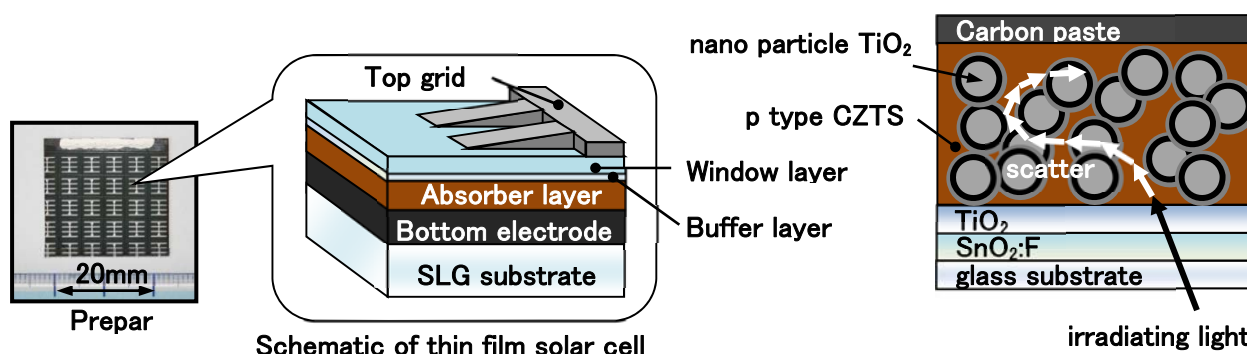


Fig.1 Schematic of thin film solar cell.  
 (Al/ZnO:Al/CdS/CZTS/Mo/SLG) structure

Fig.2 Schematic of 3D cell.

### Available Facilities and Equipment

Field-Emission Scanning Electron Microscope (JEOL)	Vacuum evaporator (SHINCRON)
Screen printing machine(NEWLONG)	Deep UV Lump (USHIO)
LCR mater (NF Corporation)	Photo-chemical deposition system (handmade)