Area: 2

RECENT PROGRESS IN HIGH EFFICIENCY PURE SULFIDE CIGS SOLAR CELLS

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A conversion efficiency of 16.9% on a pure sulfide Cu(In,Ga)S_2 (CIGS) solar cell with a Cd-free buffer layer was achieved. These three years, we have engaged in development of pure sulfide CIGS solar cells for potentially low cost absorber as one of candidates of post-Cu(In,Ga)(Se, S)$_2$ (CIGSeS) solar cells. In 2015, efficiency of 14% was demonstrated by optimizing sulfurization temperature and modifying profile of Ga grading. Last year, efficiency of 15.5% was achieved by applying a wide bandgap $Zn_{1-x}Mg_xO$ buffer layer instead of a CdS buffer layer. Further optimization of Mg content in the $Zn_{1-x}Mg_xO$ and improvement of interface between the CIGS absorber and the Mo electrode contributed to current our champion efficiency of 16.9%. As compare with conventional CIGSeS solar cells, there is still big efficiency gap due to large V_{oc} deficit and high series resistance. From detailed analysis, we concluded that the short minority carrier lifetime and the low carrier density should be the bottleneck for the efficiency improvement. In this presentation, we will review our recent progresses in efficiency improvement on pure sulfide CIGS solar cells, and also would like to discuss future prospect.

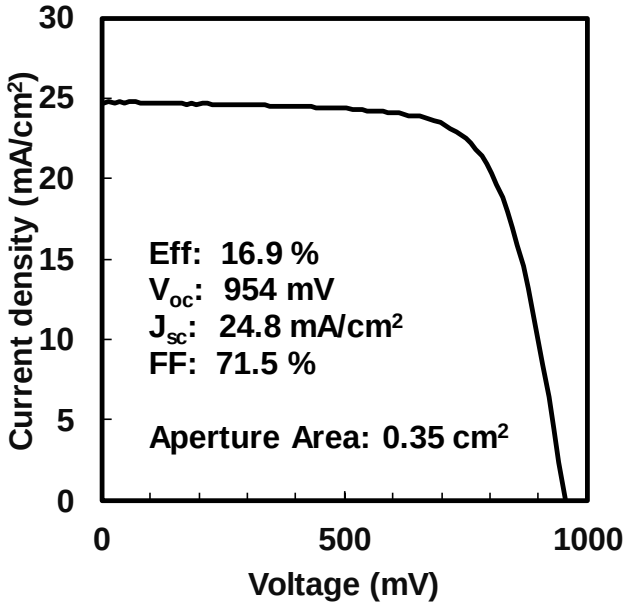

Figure 1: J-V curve of pure sulfide CIGS solar cell with Cd-free buffer layer (in-house measurement).