

Effect of Additional Indium Deposition after Cu(In,Ga)Se₂ Thin Film Growth for Potassium Fluoride Post-deposition Treatment

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The introduction of potassium fluoride post-deposition treatment (KF-PDT) has opened the experimental potential for higher efficiencies. Until now, a little is known about the effect of KF-PDT on CIGS thin films. Due to this, here, we investigated the role of KF-PDT on CIGS thin films by additional indium deposition after CIGS growth. CIGS absorber layers were deposited onto Mo/soda-lime glass (SLG) substrate using molecular beam epitaxy (MBE) system. In a typical experimental process, four sets of CIGS absorber layers were deposited and the additional indium depositions were performed for these samples for 0, 30, 60 and 120 sec. respectively (after CIGS growth). KF-PDT was performed on these absorber layers under identical condition. CIGS solar cells were fabricated with MgF₂/Ni/Al/ZnO:Al(300nm)/ZnO(100nm)/CBD-CdS(70nm)/CIGS(2.3~2.5μm)/Mo/SLG structure.

Fig. 1(a) shows the basic solar cell parameters of CIGS solar cells with and without KF-PDT at different indium deposition time after CIGS thin films growth. The best efficiencies were obtained at additional indium deposition for 60 sec after KF-PDT. XPS measurements revealed that additional indium at the very near surface region on CIGS absorber layer support the formation of Cu-poor thin films after KF-PDT as shown in Fig 1(b). As a result, open circuit voltage (V_{oc}) increase due to the formation of high-density shallow donor-type Cd_{Cu} during CBD-CdS process, thereby, improving the photovoltaic performances. The details of CIGS thin film properties, including XPS, SIMS, J-V, EQE, TRPL and C-V will be discussed.

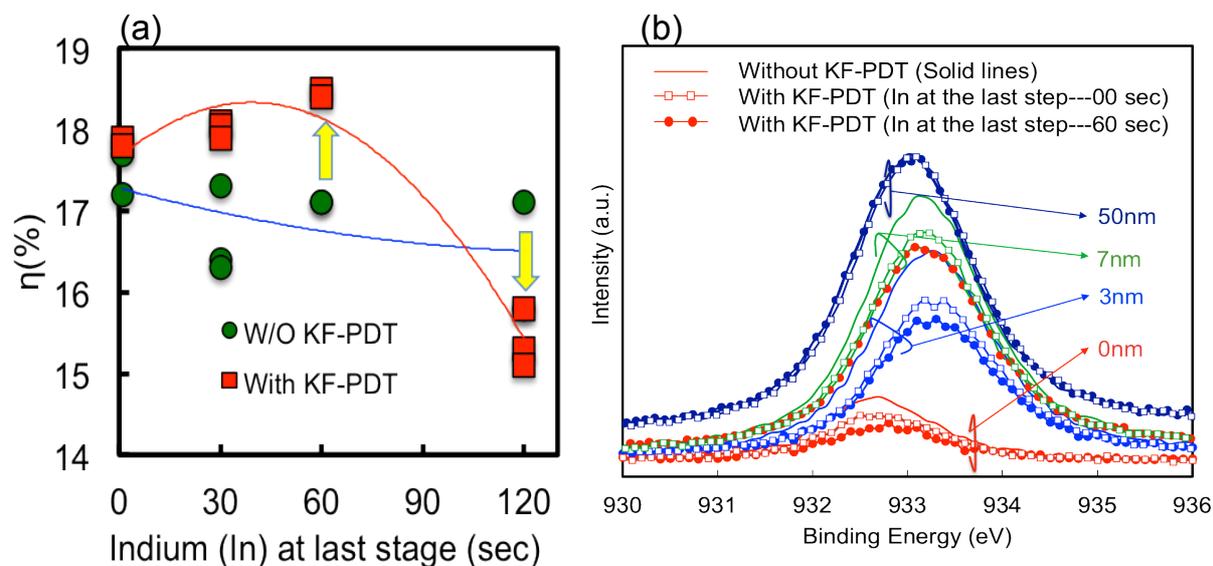


Figure 1. (a) Solar cell efficiencies of CIGS absorber layers. (b) XPS spectra of Cu 2p_{3/2} of bare CIGS thin films with (filled circles and open squares) and without (solid lines) KF-PDT at additional indium deposition of 60 (filled circles) and 0 (open squares) sec after CIGS growth.