

Investigation of the Effect of I-ZnO Window Layer on the Device Performance of the Cd-Free CIGS Based Solar Cells

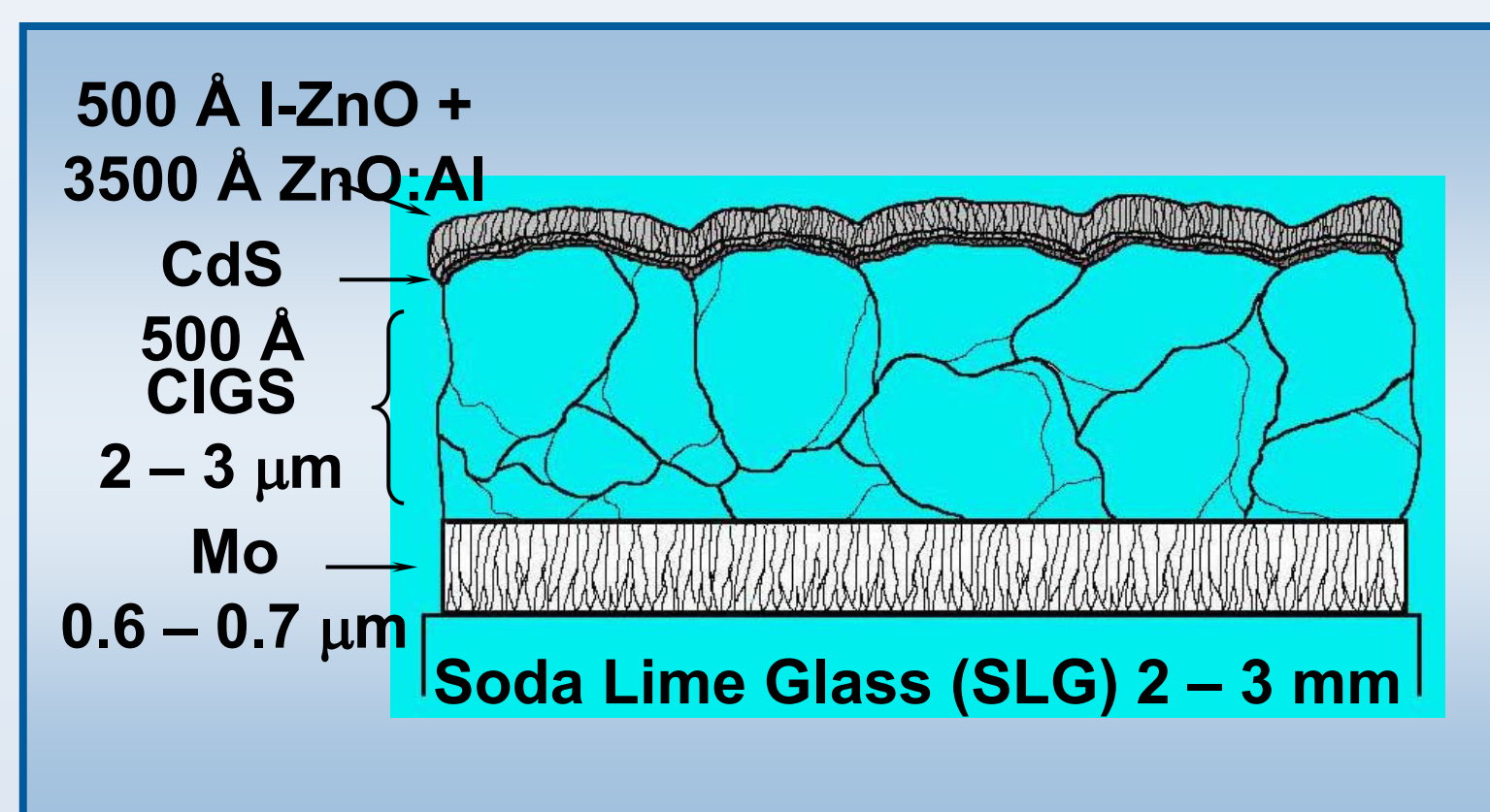
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Objective

This research work focuses on preparing Cd-free CIGS based solar cells with intrinsic high resistivity ZnO (I-ZnO) films deposited by metal-organic chemical vapor deposition (MOCVD) technique at different deposition substrate temperature and I-ZnO film thickness, and the effect of the prior treatment of CIGS films by ammonium hydroxide (NH₄OH) diluted solution on the device performance.

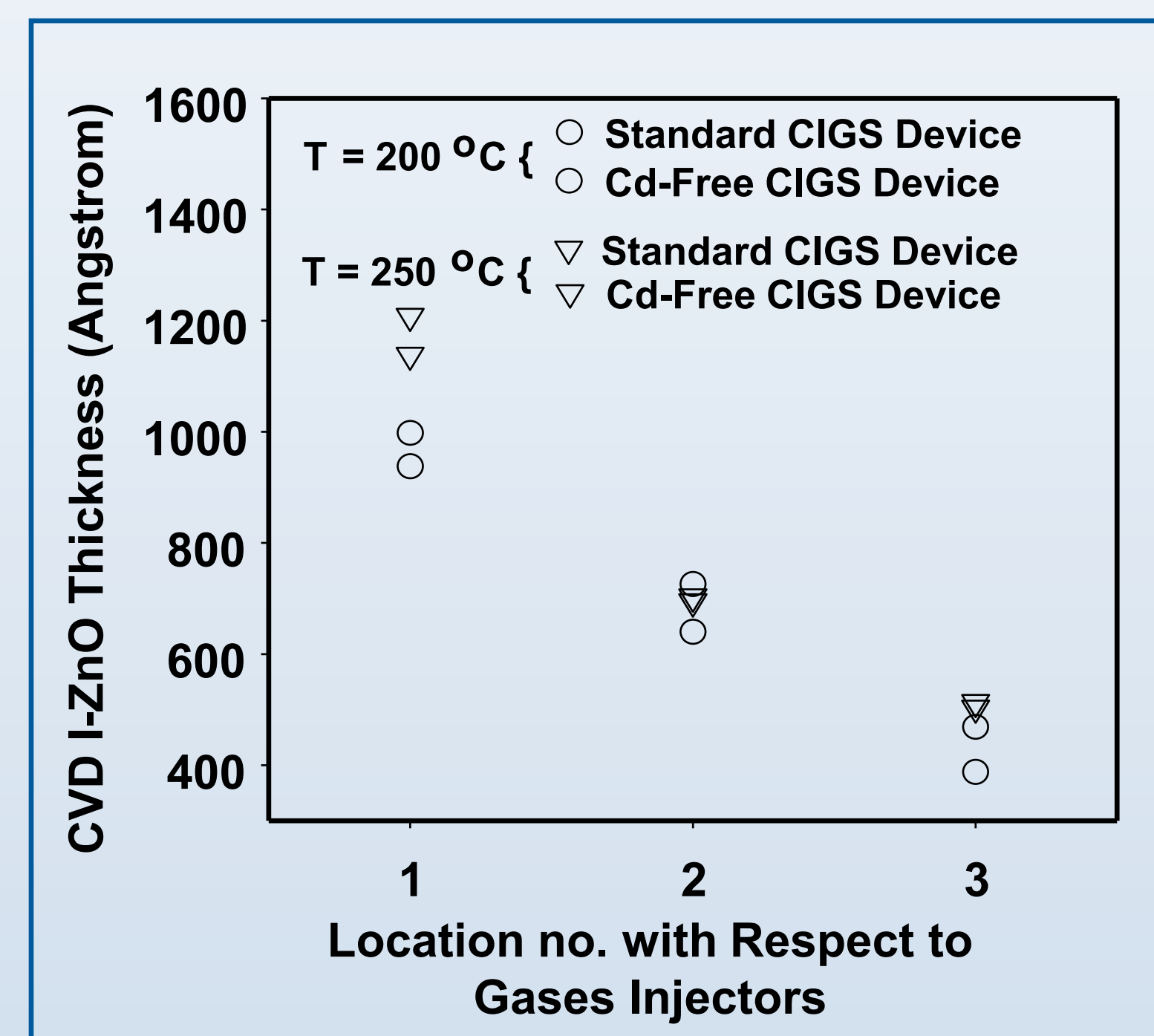
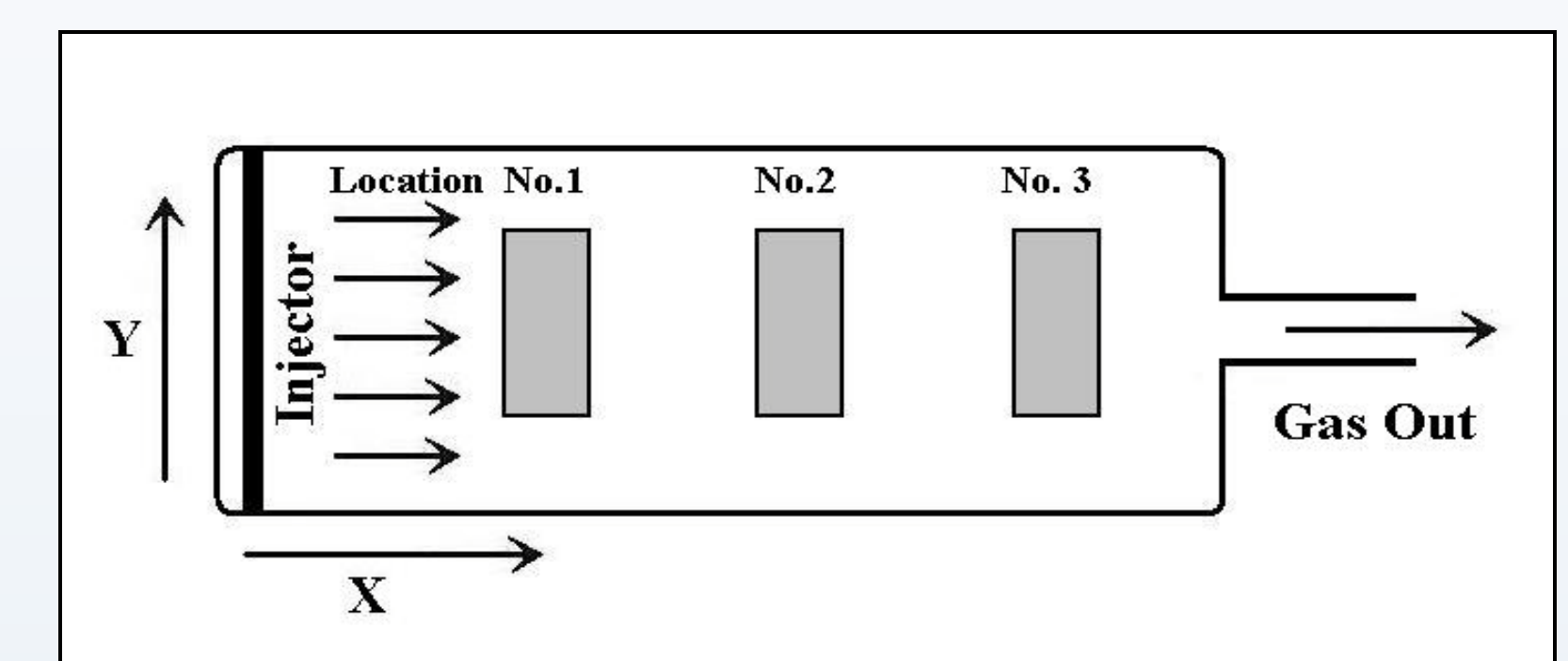


Experimental

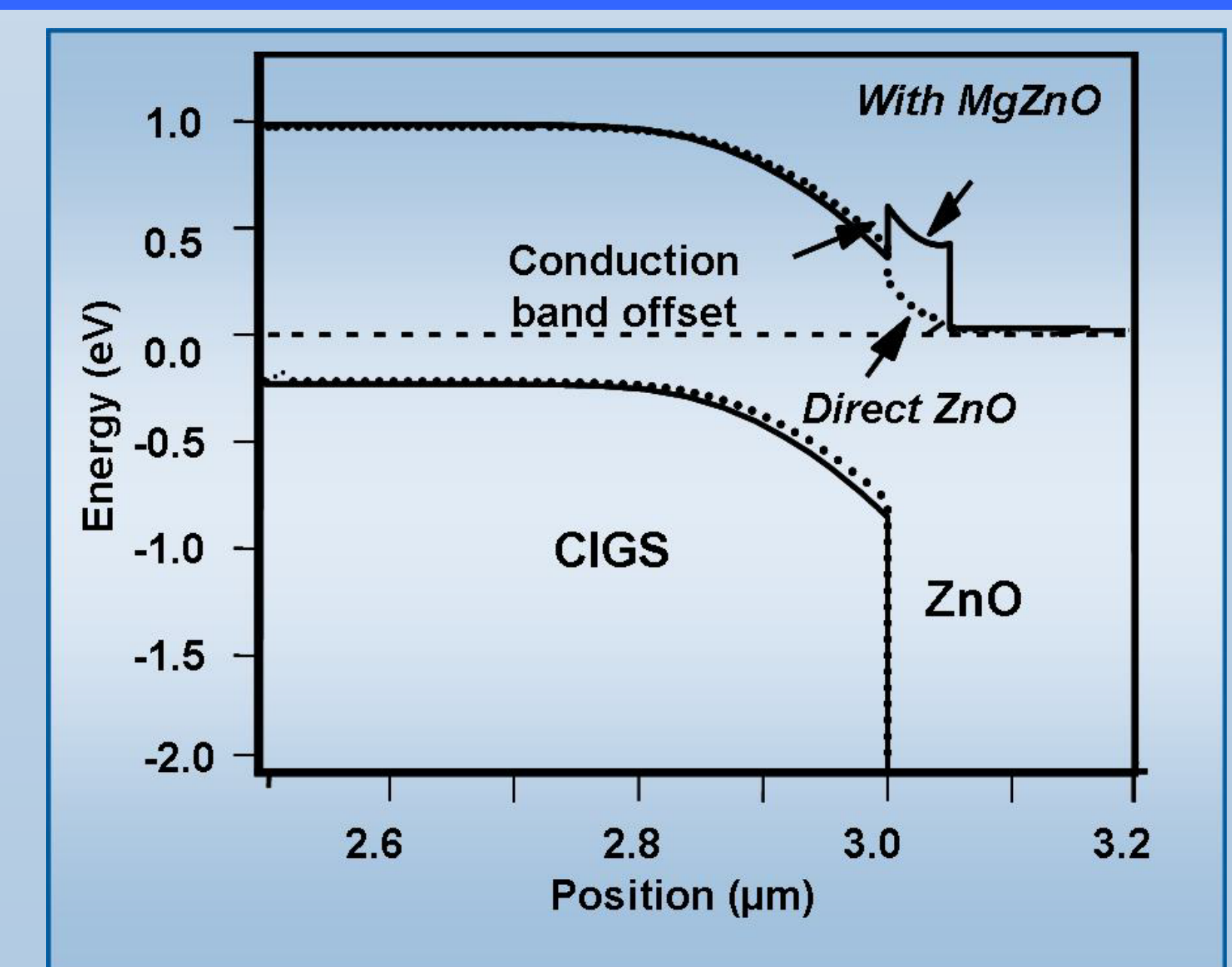
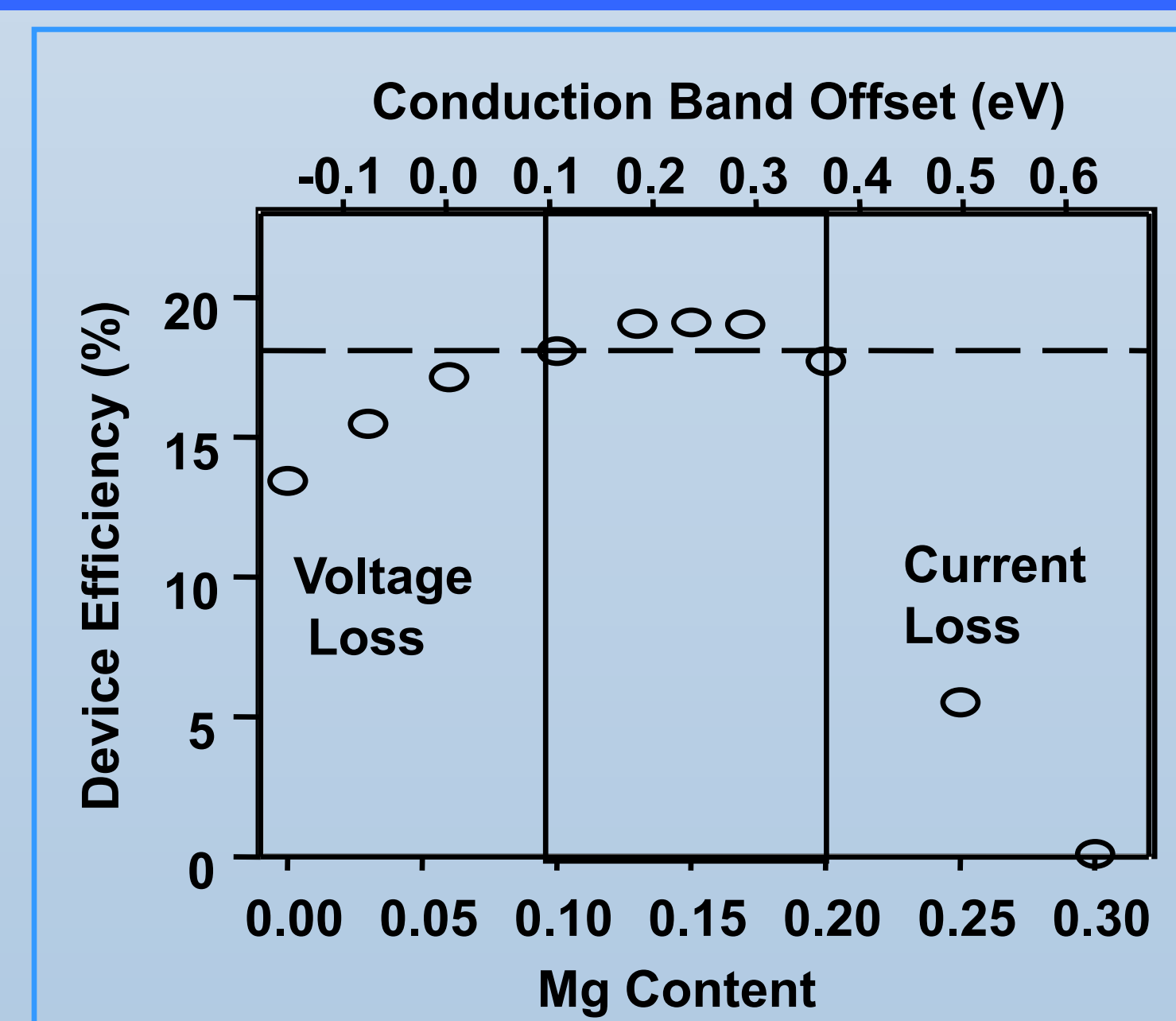
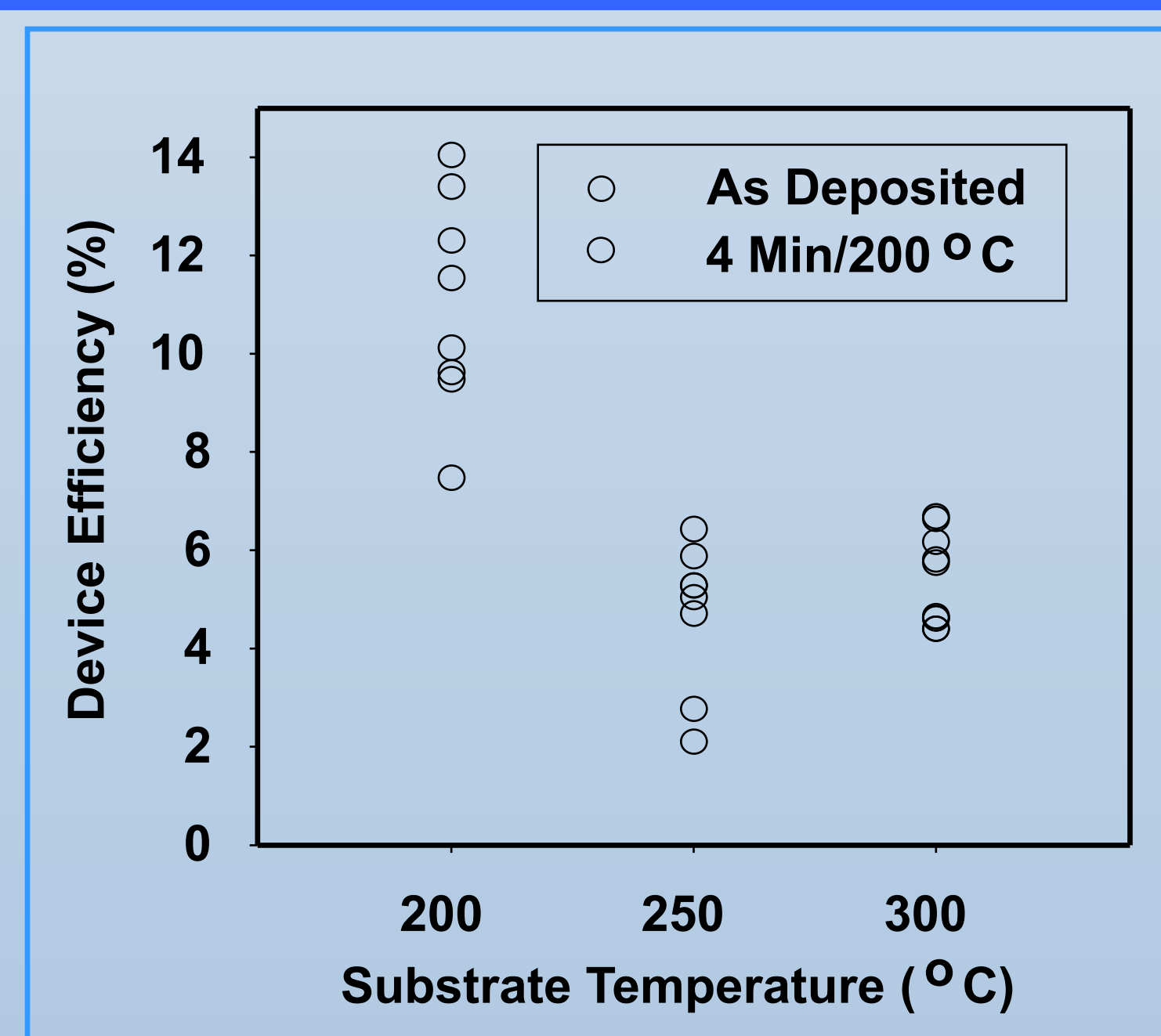
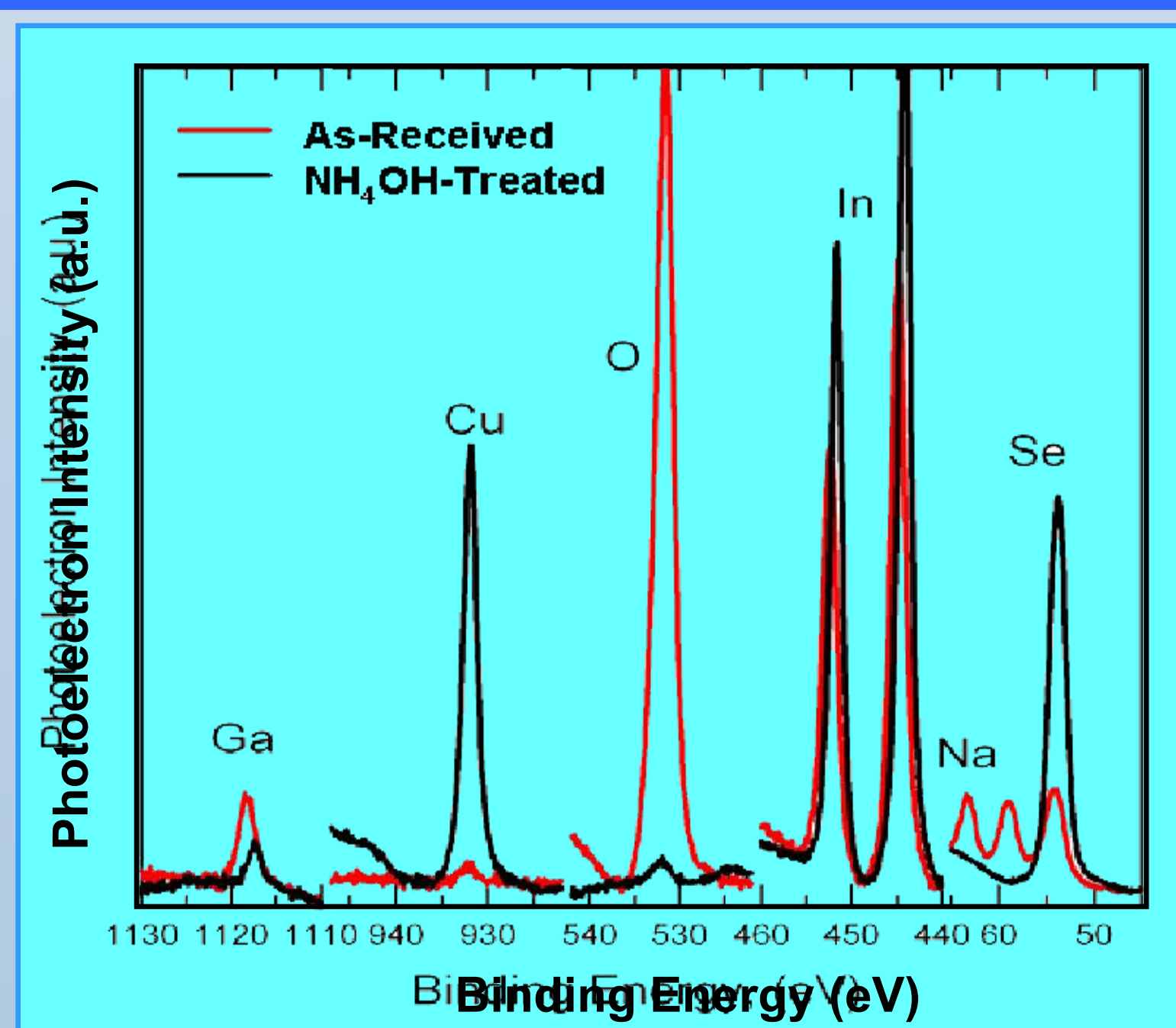
Two series of CIGS films were deposited on SLG/Mo substrates, at constant deposition rates and temperature using the 3-stage deposition process. For the subsequent buffer layer deposition, the surface of the first series of CIGS films was treated by immersing the films in ammonium hydroxide (NH₄OH) diluted solution for a period of 20 min at a bath temperature of 60°C. Then, directly the intrinsic ZnO (I-ZnO) films were deposited by a low-pressure metal-organic chemical vapor deposition (LP-MOCVD). This series of NH₄OH-treated CIGS films' completed devices shall be referred to as the "Cd-free CIGS device".

The I-ZnO layer was deposited at different substrate temperatures of 200°C, 250°C, and 300°C. the total gas flow through the chamber during the deposition was between 2000-3000 sccm, while the chamber pressure was maintained at 30 Torr. Due to the chamber geometry, the deposition configuration results in linear combinatorial synthesis and linear variation in thickness of the deposited thin films.

For the second series of CIGS films, a standard CdS buffer layer was deposited by Chemical Bath Deposition (CBD). Subsequently, I-ZnO window layer was deposited using MOCVD at the similar conditions of that used for series of CIGS films. Hence, this series after device completion will be referred to as "standard CIGS devices".



Results



Summary