Cadmium sulfide (CdS) layer was replaced with zinc sulfide (ZnS) thin film due to toxicity. ZnS thin films were fabricated by wet chemical process. The ZnS thin films were analyzed by adding EDTA (ethylenediamine tetra-acetate acid) and HMTA (hexamethlene tetramine). Inhibition of Zn(OH)$_2$ and uniformity are important factors for the ZnS thin film. The morphologic of the ZnS buffer layer was closely related to the use of a complexing agent that controls the concentration of Zn$^{2+}$ ions and Zn(OH)$_2$ during the deposition process. The complexing agent EDTA accelerated the cluster - cluster method to grow the thin film quickly but it had lower uniformity and greater cracking phenomenon. The HMTA could be effectively applied to increase the amount of Zn$^{2+}$ ions forming ZnS. It was easily formed as Zn$_2$HMTA at high temperatures. The results of the experiment with the addition of HMTA revealed that the surface of the thin film did not change with increasing of the HMTA concentration, but the thickness of the thin film increased gradually. HMTA promoted the ion-ion method to grow the thin film uniformly, but the rate was low. Additionally, experiment with EDTA and HMTA mixed complexing agent was executed. The best ZnS thin film with band gap of 3.7 eV and denser surface was prepared by HMTA complexing agent.

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