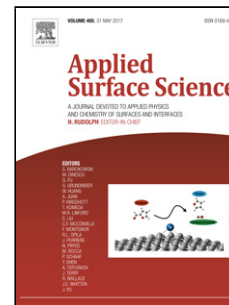


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Electrodeposition mechanism of quaternary compounds $\text{Cu}_2\text{ZnSnS}_4$: effect of the additives

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Abstract

The electrodeposition mechanism of pure phase $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) thin film with subsequent annealing was investigated in detail. An electrolyte design principle of quaternary compounds was proposed. The complex ions of $\text{Cu}(\text{H}_2\text{C}_6\text{H}_5\text{O}_7)^+$, $\text{Cu}_2(\text{C}_6\text{H}_5\text{O}_7)^+$, $\text{Zn}(\text{C}_4\text{H}_5\text{O}_6)^+$, $\text{Sn}(\text{H}_2\text{C}_6\text{H}_5\text{O}_7)^+$ and $\text{Sn}_2(\text{C}_6\text{H}_5\text{O}_7)^+$, which influenced the reduction process and played important roles in co-deposition, were identified by UV spectra. Electrochemical studies indicated that trisodium citrate and tartaric acid could narrow the co-deposition potential range of the four elements to -0.8 V~-1.2 V (vs. SCE). The cause was the synergetic effect that trisodium citrate inhibited the reduction of Cu^{2+} and Sn^{2+} and tartaric acid promoted the reduction of Zn^{2+} . The reduction of $\text{S}_2\text{O}_3^{2-}$ was mainly attributed to the induction effect of the metallic ions, and the H^+ dissociated from tartaric acid could also promote the cathode process of

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