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Effect of Tungsten Incorporation in Cobalt Tungsten Alloys as Seedless Diffusion Barrier Materials

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Abstract

With the increase in the aspect ratio of the interconnect features in integrated circuits, the direct electroplating of Cu on diffusion barrier without sputtered Cu seed layers is attracting more and more attention. In this study, direct electroplating of Cu onto sputtered CoW films with various W concentration in acidic $CuSO_4$ solution is investigated. Also, the adhesion and anti-diffusion properties of the CoW thin films for Cu are ~~also~~ explored. The results show that Cu films cannot be electrodeposited on thin Co layers due to corrosion of Co in the acidic bath. For CoW alloys, higher W concentration is found to be beneficial for suppressing corrosion of CoW films and also improving the thermal stability. However, on the surface of Cu/CoW films with high W concentration, Cu agglomeration and pin-holes were found after annealing, indicating poor adhesion between Cu and high-W-content CoW alloys. In this study, CoW alloys with moderate W concentration around 50% are found to be a direct

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