Improving the Electrical Integrity of Cu/CoSi2 Contacted n+-p Junction Diodes Using Nitrogen-Incorporated Ta Films as a Diffusion Barrier

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Abstract

The study on improving the electrical integrity of Cu–CoSi2 contacted-junction diodes by using the reactively sputtered TaN as a diffusion barrier is presented in this paper. In this study, the Cu(300 nm)–CoSi2(50 nm)/n+p junction diodes were intact with respect to metallurgical reaction up to a 350 C thermal annealing while the electrical characteristics started to degrade after annealing at 300 C in N2 ambient for 30 min. With the addition of a 50-nm-thick TaN diffusion barrier between Cu and CoSi2, the junction diodes were able to sustain annealing up to 600 C without losing the basic integrity of the device characteristics, and no metallurgical reaction could be observed even after a 750 C annealing in furnace. In addition, the structure of TaN layers deposited on CoSi2 at various nitrogen flow rates has been investigated. The TaN film with small grain sizes deposited at nitrogen flow ratios exceeding 10% shows better barrier capability against Cu diffusion than the others.