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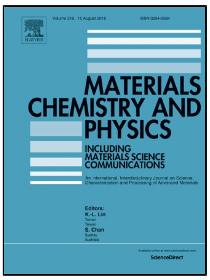

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Evaluation of Cu(Ti) and Cu(Zr) alloys in barrier-less Cu metallization

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Abstract

The thermal properties of Cu(Ti)/SiO_2 and Cu(Zr)/SiO_2 systems have been investigated to evaluate the potential application for Cu metallization. Cu(Ti) and Cu(Zr) alloy films were directly deposited on SiO_2/Si substrates and subsequently annealed in vacuum at various temperatures of 300°C-700°C for 1 hour. The microstructure, interface characteristics, and electrical properties of both samples were measured using X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), transmission electron microscope (TEM) and leakage currents detector. Results suggest that Cu alloy films have strong Cu(111) texture after the addition of a small amount of Zr or Ti. The sharp decline of Cu and Si concentrations at the interface suggest that both Ti and Zr addition can prevent the inter-diffusion between Cu and substrate. The leakage current densities of Cu(Zr) and Cu(Ti) show that Zr is more stable element to self-forming diffusion layer for advanced Cu interconnects.

Keywords: Interfaces; Thin films; Alloys; Sputtering; Diffusion;

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