

# Nanostructured TaN(O)/TaN Barrier Film Formed by Oxygen Plasma Treatment for Cu Interconnect

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## 摘要

Oxygen plasma was used to treat an ultrathin TaN barrier layer (10 nm) to improve barrier performance. X-ray diffraction, transmission electron microscopy, and measurements of electrical properties, were used to evaluate the barrier performance against Cu diffusion. Nanocrystallization and oxidation occurred after treatment with oxygen plasma. A nanostructured amorphous TaN(O) layer with a grain size of ~2 nm was formed on the surface of the TaN layer. The Cu/TaN/n+-p junction diodes resulted in large leakage currents after annealing at 525°C for 1 h, while the Cu/TaN(O)/TaN/n+-p junction diodes retained their electrical integrity after annealing at 650°C. Nanocrystallization effects of plasma treatments are believed to be able to suppress Cu penetration into the Si substrate and, hence, improve the barrier performance. Nanostructured amorphous barrier layers can lengthen grain structures to alleviate effectively Cu diffusion, thereby acting as much more effective barriers than conventional TaN films.