
Cu diffusion behavior in SiOC(-H) films with annealed Cu/SiOC(-H)/*p*-Si(100)/Al metal-insulator-semiconductor (MIS) structures

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SiOC(-H) films with low dielectric constants have been prepared by using plasma enhanced chemical vapor deposition (PECVD) is currently being used in interconnect applications. And deposited SiOC(-H) films were annealed at the temperature from 250 °C to 450 °C in vacuum. Cu electrode deposited by thermal evaporation. Electrical testing of metal-insulator-semiconductor capacitors is used to assess Cu diffusion in the dielectric and Cu⁺ ion drift rate in SiOC(-H) films evaluated by C-V with flat band shift by BTS(bias temperature stress). Stressing at temperatures of 150–250 °C and electric fields up to 1 MV/cm was conducted to investigate the penetration of Cu⁺ ion into SiOC(-H) films. And Cu⁺ ion drift diffusion is observed by TEM (Transmission Electron Microscopy) image and by Cu⁺ ion diffusion behavior analyzed by AES (Auger Electron Spectroscopy) depth profile. The drift diffusion experiments indicate that the Cu⁺ ion drift rate in the film is increased with increasing annealing temperature of SiOC(-H) films. Failure mechanism of SiOC(-H) film was related to the degradation of the dielectric by Cu⁺ ion drift.