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Leakage current and electrical breakdown in plasma enhanced chemical vapor deposited low dielectric constant SiOC(-H) films

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Low dielectric constant materials are required for the interconnect dielectric (ILD) to reduce propagation delays, cross-talk noise between metal wires and power dissipation from *RC* coupling. One of this integration challenges with new ultra low-*k* generation materials is their electrical properties and reliability issues. In this paper, the low dielectric constant SiOC(-H) films are deposited on *p*-type Si(100) substrates by plasma enhanced chemical vapor deposition using DMDMS and oxygen gas as precursors. And deposited SiOC(-H) films were annealed at the temperature from 250 ℃ to 450 ℃ in vacuum. Electrical conduction in the dielectric constant SiOC(-H) films depends on two main conduction mechanisms: Schottky emission and Poole-Frenkel emission. Schottky barrier height of the interface between Cu and SiOC(-H) film for SE conduction and trap potential well in SiOC(-H) films for PF conduction is calculated. The trap barrier height has been extracted from the temperature dependence of leakage current. The activation energy of annealed SiOC(-H) films determined by PF I-V curve. And we found that as annealing temperature increase, increase the leakage and reduce the breakdown strength.