Low-k SiCOH Films by Plasma Enhanced Chemical Vapor Deposition using Divinyldimethylsilane

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SiCOH films were deposited with plasma-enhanced chemical vapor deposition (PECVD) using divinyldimethylsilane (DVDMS) as a precursor and O2 as an oxidant. As-deposited films and the films annealed at 450°C have been characterized. The growth rate decreased with increasing substrate temperature and O2/precursor ratio and increased with increasing plasma power. The dielectric constant was decreased with carbon incorporation into the oxide film. The refractive index of the as-deposited films was about 1.46-1.49 and decreased to 1.36 after annealing due to the lower densification and increased porosity of the film. After annealing, SiCOH films showed a low dielectric constant of 2.2 at optimum condition. Leakage current has a low value of 6.45×10-6 A/cm2 at 1MV/cm. The SiCOH film after annealing had 1 order of magnitude lower leakage current density than that of the as-deposited film. The breakdown fields of the films are higher than 9MV/cm, indicating the films are suitable candidates for the back-end dielectric of VLSI interconnects.