Plasma copolymerization of ultra-low dielectric constant SiCOH films using octamethylcyclotetrasiloxane and tetraethylorthosilicate precursors

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Octamethylcyclotetrasiloxane (OMCTS) and tetraethylorthosilicate (TEOS) are well-known materials which are widely used to fabricate plasma polymerized low dielectric films as interconnect dielectric. The SiCOH films were deposited with OMCTS and TEOS precursors by using the plasma enhanced chemical vapor deposition (PECVD) system. A ratio of OMCTS and TEOS was adjusted by control the flow rate of precursor carrier gases into the process chamber. In case of the conventional plasma polymerized low dielectric SiCOH film, they needed the post process to make pores by vaporization of progen (e.g. hydrocarbon) for decreasing the dielectricconstant (k). However, the authors intended the deposition of SiCOH films, which does not need the post process to form the pore by using the dual precursors having different structures. The OMCTS and TEOS have different structures which were ring and linear shapes, respectively. Plasma copolymer of OMCTS and TEOS showed the lowest dielectric constant (k ~ 2.1) with plasma power of 10 W. The authors have investigated the chemical structures and compositions of SiCOH films by using Fourier transform infrared spectroscopy (FTIR). The electrical properties of the SiCOH film, i.e. dielectric constant and leakage current, were analyzed in relation to Si related components and structures of the deposited SiCOH films.