The use of low dielectric constant materials in the on-chip interconnect process reduces interconnect delay, power dissipation and crosstalk noise. In chemical vapor deposited (CVD) hydrogenated silicon oxycarbides (SiCOH) which are used as intermetal dielectric (IMD) materials the substitution of oxygen in SiO\textsubscript{2} by methyl groups (-CH\textsubscript{3}) reduces the permittivity significantly (\(\kappa=4.0\rightarrow2.6-3.3\)), since the electronic polarizability is lower for Si-C bonds than for Si-O bonds. However, plasma processing for resist stripping, trench etching and post-etch cleaning removes C and H containing molecular groups from the near-surface layer of SiCOH. Therefore, compositional analysis and chemical bonding characterization of structured IMD films with nanometer resolution is necessary for process optimization.

SiCOH thin films as-deposited and after plasma treatment are studied using X-ray absorption spectroscopy (XAS) and electron energy loss spectroscopy (EELS). In both techniques, the fine structure near the C1s absorption or energy loss edge, respectively, allows to differentiate between C-H, C-C, and C-O bonds, and consequently, between individual low-k materials and their modifications. The O1s signal is less selective to individual bonds. XAS spectra have been recorded for unpatterned films and EELS spectra for patterned structures. The chemical bonding is compared for as-deposited and plasma-treated low-k materials. Examination of the C 1s near-edge structures reveal a modified bonding of the remaining C atoms in the plasma-treated sample regions.