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Mass Density and Composition of low-k SiC_xH Thin Film Dielectrics as Determined by Fourier Transform Infrared Spectroscopy
SEAN KING, Intel Corporation — Fourier Transform Infrared (FT-IR) Spectroscopy has long been utilized as an analytical technique for qualitatively determining the presence of various different chemical bonds in gases, liquids, and thin dielectric films. Quantitative measurements of the concentration or density of different chemical bonds have also been achieved utilizing FTIR via cross calibrating the intensity for particular absorption band against a known standard. In this paper, we demonstrate that FT-IR can be further extended to quantitatively determine the concentration of multiple chemical bonds in dielectric thin films of interest to the microelectronics industry. In turn, knowledge of the full bond concentrations allows accurate determination of the mass density and full elemental composition of the film. This capability is demonstrated for a- SiC_xH thin films deposited by plasma enhanced chemical vapor deposition (PECVD). The resulting FTIR mass density and compositional analysis determined by this technique shows an excellent correlation to similar measurements by X-ray Reflectivity, X-ray Photoelectron Spectroscopy, and Scanning Ion Mass Spectroscopy.

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