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Second-harmonic generation measurements of porous low-k dielectric materials[1] JOANNA ATKIN, DAOHUA SONG, ROBERT LAIBOWITZ, Columbia University, EDUARD CARTIER, THOMAS SHAW, ROBERT ROSENBERG, IBM T. J. Watson Research Center, Yorktown Heights, NY 10598, TONY F. HEINZ, Columbia University, New York, NY 10027 — Low-k dielectric materials based on porous carbon-doped oxides, with relative dielectric constants as low as 2.1, are widely used in the microelectronics industry. Knowledge of these materials' basic electronic properties, such as energy gaps, barrier heights, and trap states, is essential for developing an understanding of their electrical leakage and stability characteristics. In this paper, we present the results of measurements of optical second-harmonic generation (SHG) from thin films of the low-k material deposited on silicon. SHG measurements at low laser fluence probe the nature of interfacial trap states. At higher fluence, multiphoton charge injection is produced by the femtosecond laser pulses and yields a time dependence of the SHG signal. Analysis of these measurements provides information about barrier heights. The results of these non-contact optical measurements will be compared with C-V characterization of the dielectric films.

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