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Optical Spectroscopy of Low-k Dielectric Films¹

JOANNA ATKIN, DAOHUA SONG, SRIKANTH IYER, Columbia University, NILS HOIVIK, ROBERT R. ROSENBERG, THOMAS M. SHAW, IBM T. J. Watson Research Center, Yorktown Heights, NY 10598, ROBERT B. LAIBOWITZ, TONY F. HEINZ, Columbia University, New York, NY 10027 — Low-k dielectric materials based on porous carbon-doped oxides are widely used in the microelectronics industry. Despite their importance, relatively little is known about their spectroscopic properties. In this paper we report results of two classes of optical spectroscopy measurements, absorption spectroscopy and photocurrent spectroscopy. Optical absorption spectroscopy has been performed on various thin-film low-k materials. These measurements show the presence of strong optical absorption in the ultraviolet and yield the effective band gap of the medium. Photocurrent spectroscopy has been performed on films of low-k material deposited on both Si and metallic substrates using a transparent counter-electrode. A well-defined spectral dependence of the photocurrent efficiency is observed. The data provide information on the band offsets of the low-k materials, parameters that play a crucial role in models of electrical conduction.

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