Optical Spectroscopy of Low-k Dielectric Films

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Columbia University, New York, NY 10027 — Low-k dielectric materials based on
porous carbon-doped oxides are widely used in the microelectronics industry. De-
spite 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 spec-
troscopy has been performed on various thin-film low-k materials. These measure-
ments 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 trans-
parent 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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