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THz Time Domain Spectroscopy Studies of a Graphite Film and Perforated Graphite Hole Arrays[1] AJAY NAHATA, THO NGUYEN, VALY VARDENY, University of Utah — We studied the optical properties of highly ordered pyrolytic graphite (HOPG) films in the 0.1 to 0.5 THz spectral range using the technique of time domain THz spectroscopy. HOPG has a low free carrier density, and highly anisotropic conductivity tensor, having much higher in-plane conductivity compared to that of the out-of-plane. First we studied a thin graphite film for obtaining the spectra of both real and imaginary components of the dielectric constant, from which we obtained the free carrier relaxation time. Subsequently we fabricated and investigated hole arrays in an otherwise opaque graphite film, which consist of *periodic* hole array ("plasmonic lattice"), and corresponding *random* hole array. For the periodic hole array we found that the transmission spectrum is modulated with several resonance/anti-resonances that correspond with the reciprocal vectors in the Fourier space; whereas a broad transmission band of which peak depends on the hole diameter characterizes the random hole arrays.

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