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The Optical Conductivity and Dielectric Constant of Polyaniline Nanofiber-based Film OLUDUROTIMI O. ADETUNJI, NAN-RONG CHIOU, ARTHUR J. EPSTEIN, The Ohio State University, Columbus, OH 43210-1117 — We report the optical properties of polyaniline/HCl nanofiber (PANN) films with interconnecting nanofibers of average diameter 100 nm. The room temperature dc conductivity is in the range of 2-4 S/cm in the insulating regime of the disorder induced metal- insulator (M-I) transition [1]. PANN films were probed by reflectance spectroscopy at room temperature over a broad energy range 2meV-6eV. The reflectance (<4200 cm^{-1}) increases monotonically as the frequency is lowered but has no indication of a plasma edge. Optical constants such as frequency dependent dielectric constant and frequency dependent conductivity have been derived via Kramers-Kronig (K-K) analysis of the reflectance data using appropriate extrapolations. The resulting optical conductivity extrapolated to near-zero frequency scales is in agreement with the measured dc conductivity of 2-4 S/cm [2]. A maximum of the frequency dependent conductivity is found at $\sim$ 2400 cm^{-1} while the K-K analysis shows no zero crossing of the dielectric constant between 40-50000 cm^{-1}. We discuss these results in terms of roles of disorder and localization. This leads us to the conclusion that PANN films are on the insulating side of the disorder induced metal- insulator transition. [1]R.S. Kohlman, et al., PRL 77, 13 (1996) [2]N.-R. Chiou and A.J. Epstein, Adv. Mater. 17, 1679 (2005) Supported in part by NSF-IGERT Grant No DGE-0221678.

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