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Enhanced electron mobility of n-channel polymer thin film transistors by use of low-k polymer dielectric buffer layer FELIX SUNJOO KIM, SAMSON JENEKHE, University of Washington — Understanding the factors that govern charge transport in polymer thin film transistors is of interest in developing high-performance polymer transistors and circuits. Engineering the dielectric properties of the gate insulator of a field-effect transistor represents one of the promising approaches to improving the performance of the devices. We show that insertion of a low-k polymer dielectric layer between a silicon dioxide gate dielectric and poly(benzobisimidazobenzophenanthroline) (BBL) semiconductor of n-channel organic transistors increases the field-effect electron mobility by two orders of magnitude. The enhanced electron mobility was accompanied by increased on/off current ratio, superior multicycling stability with negligible hysteresis, and enhanced durability in air. Systematic studies of a series of polymer dielectrics showed that the electron mobility increased exponentially with decreasing dielectric constant, which can be understood in terms of the reduced energetic expense of charge carrier/dipole interaction.

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