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Anomalous charge storage exponents of organic bulk heterojunction solar cells.[1] PRADEEP NAIR, RAAZ DWIVEDI, GOUTAM KUMAR, Dept of Electrical Engineering, IIT Bombay, DEPT OF ELECTRICAL ENGINEERING, IIT BOMBAY TEAM — Organic bulk heterojunction (BHJ) devices are increasingly being researched for low cost solar energy conversion. The efficiency of such solar cells is dictated by various recombination processes involved. While it is well known that the ideality factor and hence the charge storage exponents of conventional PN junction diodes are influenced by the recombination processes, the same aspects are not so well understood for organic solar cells. While dark currents of such devices typically show an ideality factor of 1 (after correcting for shunt resistance effects, if any), surprisingly, a wide range of charge storage exponents for such devices are reported in literature alluding to apparent concentration dependence for bi-molecular recombination rates. In this manuscript we critically analyze the role of bi-molecular recombination processes on charge storage exponents of organic solar cells. Our results indicate that the charge storage exponents are fundamentally influenced by the electrostatics and recombination processes and can be correlated to the dark current ideality factors. We believe that our findings are novel, and advance the state-of the art understanding on various recombination processes that dictate the performance limits of organic solar cells.

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