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Electrochemical Activation of Radical Polymers for Transparent, Ambipolar Organic Transistors SEUNG HYUN SUNG, BRYAN BOUDOURIS, Purdue University — Closed-shell macromolecules, especially π-conjugated polymers, have been widely investigated as charge transporting materials for organic electronic devices. Despite their tremendous progress, there are still a number of demands for more functionality in these systems. To meet these critical needs, we firstly introduce a non-conjugated oxidation-reduction (redox) active polymer transistor with open-shelled, charge transporting macromolecules, radical polymers. A large population of the stable redox sites in the radical polymer allow for the rapid electron transfer in solid state. The charge transport mechanism of a model radical polymer, poly(2,2,6,6-tetramethylpiperidine-1-oxyl methacrylate) (PTMA), is established through the application of an ion gel gate. In this system, the ion gel gate acts as a solid electrolyte for ionic penetration into the PTMA layer by low gate potentials. In addition, the balanced redox nature leads to a transparent transistor with ambipolar characteristics. As a result, the activated charge mobility and conductivity values of PTMA are comparable to common semiconducting polymers. Furthermore, the electrochemical doping of PTMA produces ON/OFF current ratios of $\sim 10^4$ indicative of high performance as an organic transistor.

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