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Large Perturbation Transient Photovoltage for the Study of Lifetime and Order of Recombination in Organic Photovoltaics LINDSAY ELLIOTT, JAMES BASHAM, National Institute of Standards and Technology, KURT PERNSTICH, Zurcher Hochschule for Angewandte Wissenschaften, PRAGYA SHRESTHA, LEE RICHTER, DEAN DELONGCHAMP, DAVID GUNDLACH, National Institute of Standards and Technology — Organic photovoltaics remain a topic of tremendous research interest and continue to show promise for use in applications requiring flexible and portable energy harvesting solutions. Measurements methods to accurately quantify charge generation and recombination over a large dynamic range are crucial to understanding and improving device operation and performance. We report here on the combination of two measurements: large perturbation transient photovoltage (LTPV) and impedance spectroscopy. These techniques are employed to compare the populations of mobile and trapped charge carriers over a range of open circuit voltages. Charge carrier lifetime and order of recombination are extracted from the combined techniques for the relatively large change in charge carrier density over which the measurements are valid. To demonstrate the utility of our approach we apply these combined measurements to the well-studied polymer-fullerene pair, P3HT:PC61BM. Together, these optoelectronic techniques provide better understanding of the involvement of free-free versus free-trapped recombination and the difference between total population of generated charge and mobile charge carriers.

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