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Quantum Dot TiO_2-Ge Solar Cells CARENA CHURCH, UC Santa Cruz, ELAYARAJA MUTHUSWAMY, SUSAN KAUZLARICH, UC Davis, SUE CARTER, UC Santa Cruz — Colloidal germanium (Ge) quantum dots (CQDs) are attractive solar materials due to their low toxicity compared to Pb- or Cd- based nanocrystals (NC), low cost, and optimal, tunable bandgap for both increased IR response and potential power conversion efficiency (η) boosts from Multiple Exciton Generation (MEG). We report on the successful fabrication and characterization of spun-cast donor/acceptor type TiO_2-Ge CQD solar cells utilizing Ge colloidal quantum dots (CQD) synthesized via a facile microwave method as the active layer. We find that our Ge QD size performance-related trends are similar to other QD systems studied. Additionally, our best heterojunction devices achieved short circuit currents (J_{SC}) of 450 μA and open circuit voltages (V_{OC}) of 0.335 V, resulting in $\eta =$ 0.022%. While this represents significant increases over previous Ge CQD PV (85% over hybrid Ge-P3HT PV, 350% over Ge NC PV), our photocurrents are still much lower than other NC systems. Analysis of intensity-dependent J-V characteristics reveal that our currents are limited by a space-charge region that forms leading to unbalanced charge extraction. We conclude by discussing a variety of film treatments and device structures we have tested to increase J_{SC}.

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