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All-Carbon Photovoltaics MARCO BERNARDI, PRIYANK KUMAR, NICOLA FERRALIS, Massachusetts Institute of Technology, SHENQIANG REN, University of Kansas, JEFFREY C. GROSSMAN, Massachusetts Institute of Technology — We present an alternative scheme for nanostructured solar cells, where carbon nanomaterials are the only constituents of a bulk-heterojunction acrive layer and fulfill the role of absorbers, donors and acceptors, in the absence of conjugated polymers. Ab-initio simulations were employed to calculate the band alignment for interfaces between carbon nanotubes, fullerene derivative PCBM and reduced graphene oxide, showing the presence of Type-II and Schottky heterojunctions useful for charge separation in the active layer. Accordingly, we prepared all-carbon solar cells with optimized proportions of these three components that achieved AM1.5 efficiencies up to 1.5%, with fill factors up to 70% and increased thermal stability and lifetime compared to polymer-based devices. Our results show the potential of all-carbon solar cells as an alternative to polymer based ones: the key combination of high carrier mobility, visible and IR absorption and stability under illumination makes them suitable for next-generation flexible photovoltaics.

Marco Bernardi
Massachusetts Institute of Technology

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