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Simulation of Photon, Exciton and Charge Transports in Organic Photovoltaics based on the Dynamic Monte Carlo Method coupled with the Maxwell Equation[1] BUYOUNG JUNG, School of Mechanical Engineering, Yonsei University, Korea, JUNGWON KIM COLLABORATION, KANGMIN KIM COLLABORATION, WOOCHUL KIM COLLABORATION — Organic photovoltaics(OPVs) have received increasing attention as alternatives to inorganic solar cells. To understand the physics of OPVs, the dynamic Monte Carlo(DMC) method for simulating exciton and charge carrier movements has been regarded as a suitable method. However, simulation of light absorption has been ignored. We presented a simulation of the performance of OPVs by DMC method with solving the Maxwell equation for light absorption. We especially focused on the ordered bulk heterojunction(OBHJ) OPV which is composed of P3HT and PCBM. Our analysis indicated that locations of light absorption are different at different wavelength, which suggests that the simulation of light absorption is essential. In the wavelength of 300 to 400 nm, light absorption occurred dominantly nearby the interface between the P3HT and PCBM. This implies that the generated exciton can be more efficiently dissociated into the free charges. For wavelength longer than 400 nm, most of light are absorbed away from the interface between the P3HT and PCBM. As a result of this, the internal quantum efficiencies gradually decrease from 44.6% to 30.2% as the wavelength increases from 300 to 700 nm.

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