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A Monte Carlo approach to study transport in silicon heterojunction solar cells.[1] PRADYUMNA MURALIDHARAN, STUART BOWDEN, STEPHEN GOODNICK, DRAGICA VASILESKA, Arizona State Univ — The device performance of an amorphous silicon (a-Si)/crystalline silicon (c-Si) solar cell depends strongly on the interfacial transport properties of the device. The energy of the photogenerated carriers at the barrier strongly depends on the strength of the inversion at the heterointerface and their collection requires interaction with the defects present in the intrinsic amorphous silicon buffer layer. In this work we present a theoretical model to study the transport through the heterointerface by applying an ensemble Mone Carlo (EMC) and a kinetic Monte Carlo (KMC). The EMC studies carrier behavior at the heterointerface whereas the KMC method allows us to simulate the interaction of discrete carriers with discrete defects. This method allows us to study defect transport which takes place on a time scale which is too long for traditional ensemble Monte Carlo's to analyze. We calculate the injection and extraction of carriers via defects by calculating transition rates, i.e. probability of transition to defect states within the intrinsic amorphous silicon barrier. The KMC results allow us to quantitatively study the properties of the heterointerface barrier in terms of how it affects transport.

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