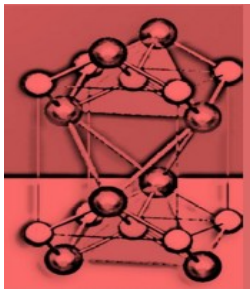

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Impact of the Poole-Frenkel effect on the electric transport of hydrogenated amorphous silicon solar cells

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The Poole-Frenkel effect (PFE) on the electrical transport of a-Si:H based p-i-n solar cells in the initial state was studied using computer simulations. The PFE has been implemented in our computer code by modifying the occupancy function and recombination rate expressions in the Shockley-Read-Hall formalism. The capture cross sections of charged states were modified by including a dependence directly proportional to the square root of the electric field, while the capture cross sections of neutral states were left unchanged. We analyze the impact of the PFE on the dark and light current-voltage characteristic curves when the effect is adopted in each layer separately and throughout the device. We found that the enhanced recombination and lower trapping through charge localized states near the interfaces can explain the changes in the current-voltage curves. Under AM1.5 illumination, the current density at low forward voltages and short circuit conditions decreased mainly when the PFE was implemented inside the intrinsic layer, while the open circuit voltage increased depending on the density of defects adopted inside the p-layer. Our results can be used to explore if the inclusion of the PFE enables a better design of a-Si:H and μc-Si:H solar cells.