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Photovoltaic applications of hydrogenated amorphous silicon thin films grown by the Saddle Field Glow Discharge Method F. GASPARI, A.I. SHKREBTII, University of Ontario Institute of Technology (UOIT), Oshawa, Canada, A. KAZAKEVITCH, UOIT, A.V. SACHENKO, I.O. SOKOLOVSKY, V. Lashkarev Institute of Semiconductor Physics NAS, Ukraine, N. KHERANI, Electrical & Computer Engineering, University of Toronto, Canada, T. TEATRO, J. PERZ, UOIT — Thin film hydrogenated amorphous silicon (a-Si:H) is widely used for photovoltaic solar cells. We present a combined theoretical and experimental study of the thin a-Si:H films for efficient and inexpensive solar cells, grown by the Saddle Field Glow Discharge Method. The type of solar cell studied is glass/SnO_2/p-i-n Si:H/Al. We investigated the mechanism of hydrogen diffusion inside the film, its relation to the bonding within the amorphous silicon network. Hydrogen diffusion in a-Si:H was modeled using first-principles finite temperature molecular dynamics. Optimization of the solar cells was performed based on the experimental diffusion coefficients, carrier mobilities, parameters of the p-i-n structures, and electron band structure (defect distribution inside the gap). An analytical model to optimize photo-conversion efficiency of a-Si:H based solar cells with contact grid has been developed. The research was supported by the Centre for Materials and Manufacturing/Ontario Centres of Excellence (OCE/CMM) "Sonus/PV Photovoltaic Highway Traffic Noise Barrier" project.

John Perz
University of Ontario Institute of Technology, Oshawa, Canada

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