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Nano-Structured Silicon Thin Films for Photovoltaic Applications

P. CRAIG TAYLOR, Colorado School of Mines

The current technology for thin-film silicon photovoltaic panels is based on hydrogenated amorphous silicon and related alloys, such as silicon-germanium and silicon-carbon. Currently there is great interest in using some form of thin-film silicon that includes nano-structured components. This interest is driven in part by the potential for decreased cost, increased efficiency, and increased stability. Also driving this interest is the abundance of silicon as an element and its lack of toxicity. I will review various structures that have been suggested, and discuss recent results on inhomogeneous films of hydrogenated amorphous silicon that contain nanocrystalline inclusions. In particular, I will describe the mechanisms for optical absorption, carrier transport and the role of defects.