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Spin-dependent processes in silicon-rich silicon-nitride thin film solar cells SANG-YUN LEE, SEOYOUNG PAIK, DANE MCCAMEY, CHRISTOPH BOEHME, Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah, JIAN HU, FENG ZHU, ARUN MADAN, MV Systems, Inc., Golden, Colorado — Silicon-rich silicon-nitride (SiN_x:H) is attracting attention due to its relevance for light emitting diodes, electrolytic devices and solar cells. Charge transport and recombination in this material are key factors for its optoelectronic properties. Since SiN_x:H is highly disordered and exhibits weak spin-orbit coupling similar to amorphous silicon (a-Si:H), many of the electronic transitions in this material take place through localized electronic states and are governed by spin-selection rules. Thus, it is possible to study these processes using electrically detected magnetic resonance spectroscopy (EDMR). Using coherent, pulsed EDMR, we observed a variety of qualitatively different spin-dependent processes. We present a mapping of the properties of these processes regarding coupling and defect type and show that the nature of many of these processes is similar to previously studied mechanisms in a-Si:H as they involve a variety of different states (dangling bonds, tails states), with various spin coupling modes (exchange, dipolar coupling). However, in contrast to a-Si:H, many of the transitions between strongly spin-coupled pairs influence the conductivity and hence they do not represent geminate recombination processes.

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