

^1H NMR IN HYDROGENATED NANO-CRYSTALLINE SILICON THIN FILMS

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Hydrogenated nano-crystalline silicon (nc-Si:H) thin films is a promising material for the multi-junction solar cells. We investigated the local hydrogen environments in nano-crystalline silicon thin films by nuclear-magnetic-resonance. At room temperature, ^1H NMR shows a much higher degree of hydrogen clustering than observed in typical a-Si:H, these hydrogen is probably located at the grain boundaries of the nano-crystallites. Comparison of room temperature spectra to those at 8 K suggests that a significant fraction of hydrogen in these films is in the form of molecular hydrogen. In addition, the fraction of dilute hydrogen, which is always present in typical amorphous silicon, is significantly lower. These results suggest that the local hydrogen order in nc-Si:H is very different from that in a-Si:H, and this local order may be responsible for certain unique optoelectronic properties of nc-Si:H thin films.