



Microstructure of Amorphous-Silicon-Based Solar Cell Materials by Small-Angle X-Ray Scattering

National Renewable Energy Laboratory (NREL)



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By -

BiblioGov. Paperback. Book Condition: New. This item is printed on demand. Paperback. 54 pages. Dimensions: 9.7in. x 7.4in. x 0.1in. This report describes work performed to provide details of the microstructure in high-quality hydrogenated amorphous silicon and related alloys for the nanometer size scale. The materials studied were prepared by current state-of-the-art deposition methods, as well as new and emerging deposition techniques. The purpose was to establish the role of microstructural features in controlling the opto-electronic and photovoltaic properties. The approach centered around the use of the uncommon technique of small-angle X-ray scattering (SAXS), which is highly sensitive to microvoids and columnar-like microstructure. Nanovoids of H-rich clusters with 1 to 4 nm sizes in a-Si: H at the 1 vol. percent level correlate with poor solar-cell and opto-electronic behavior. Larger-scale features due either to surface roughness or residual columnar-like structures were found in present state-of-the-art device material. Ge alloying above about 10 to 20 at. percent typically leads to significant increases in heterogeneity, and this has been shown to be due in part to non-uniform Ge distributions. Ge additions also cause columnar-like growth, but this can be reduced or eliminated by enhanced ion bombardment during growth. In contrast, C alloying typically...



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