

SWBXT Studies of Multicrystalline Silicon Bricks and Wafers for Solar Modules

NSLS Beamline X19C

Category of Researcher:
PRT member

Technique:
White Beam X-ray
Topography

Researchers & Affiliations:
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Motivation:

A program of research has been carried out using primarily the technique of Synchrotron White beam X-ray Topography (SWBXT) in conjunction with X-ray reticulography, optical microscopy and scanning electron microscopy (SEM) to enhance understanding and enable improved control of the processing sequence used to convert high purity silicon chunk into multicrystalline Si solar cells. This processing sequence includes the casting process used in producing multicrystalline ingots, the band-sawing of the ingots into bricks, and the wire-sawing of the bricks into wafers. Additional heat treatment steps to modify the distribution of impurities are also taken into consideration. Ultimately, the program aims to improve the quality of the cast multicrystalline silicon and thereby the efficiency of solar cells fabricated.

Experiment:

Results:

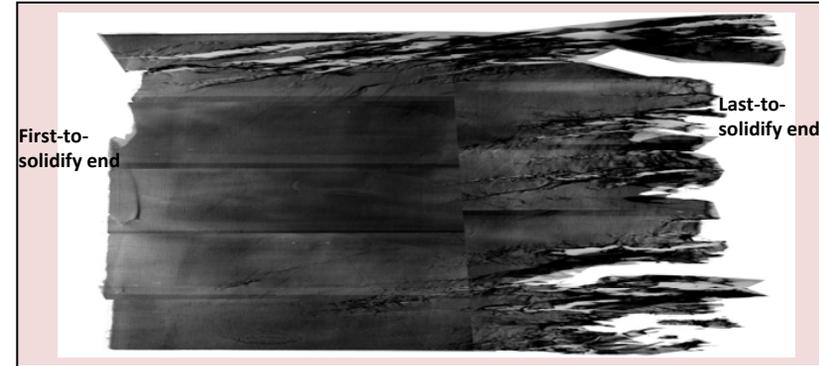


Figure 2 X-ray reflection topograph recorded from one of the faces of a directionally-solidified single crystal brick showing the evolution of the defect microstructure

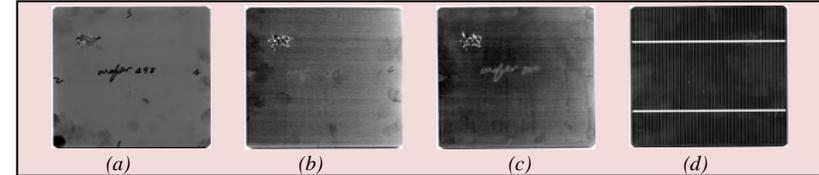


Figure 3 Optical photographs of 6" X 6" silicon wafers sliced from the first-to-solidify end of brick and processed to different stages of the solar cell fabrication: (a) Clean; (b) Etch; (c) Diffusion; (d) Print

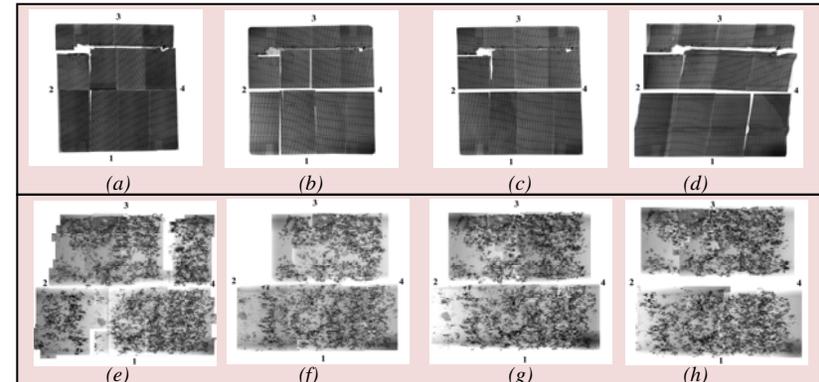


Figure 4 220 X-ray reticulographs recorded from wafers sliced from the first-to-solidify end (a, b, c, & d) and last-to-solidify end (e, f, g & h) of brick and processed to different stages of the solar cell fabrication (clean, etch, diffusion and print, respectively).

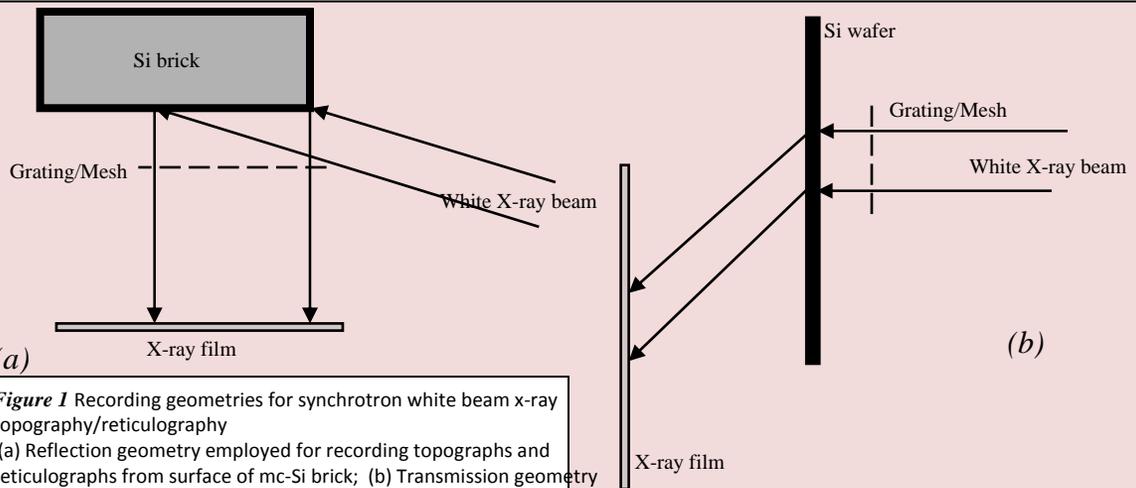


Figure 1 Recording geometries for synchrotron white beam x-ray topography/reticulography
(a) Reflection geometry employed for recording topographs and reticulographs from surface of mc-Si brick; (b) Transmission geometry employed for wafers recording topographs and reticulographs from wafers