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X-ray Reflectivity Study of Si Nanowires Grown by Ag Nanoparticle Etching

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Abstract content
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The results of x-ray reflectivity measurements on Si(100) substrates upon which Si nanowires were produced by Ag nanoparticle etching will be discussed. Using HF and H₂O₂, the Ag etches into the Si substrate to produce the nanowires, which generate optically rough surfaces that are of interest for anti-reflection in photovoltaic applications.

The reflection of x-rays from an interface provides a sensitive tool for determining interfacial structure on an atomic length scale. Because of the high electron density of Ag, x-ray reflectivity can investigate the evolution of the Ag nanoparticles during etching. A brief overview of the technique, its advantages and its limitations will be given. In particular, the highly rough surfaces that are generated introduce challenges for the technique.

Measurements were performed on a series of samples prepared for different etch times. Both Bragg diffraction and x-ray reflectivity indicate a similar Ag nanoparticle size of ~27 nm. The depth of the Ag nanoparticles relative to the position of the Si surface was determined by x-ray reflectivity as a function of etching time. The results will be compared and corroborated with electron microscopy and optical measurements performed on companion samples.

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