Recycling Silicon from Kerf

A joint India-U.S. research consortium funded under the *Joint Clean Energy Research & Development Center (JCERDC)*

Scientific Achievement:

The experimental setup to recover silicon from kerf was completed. Carbon content in swarf was reduced (10^9 ppb to 10^5 ppb) using oxidation. The distribution of Ni in Cz and CCz wafers is being studied. Solar cell fabrication process started on CCz wafer. Weighted surface reflectance of 3.6% from antireflective coating (ARC) textured surface and acceptable sheet resistance of 45–55 Ω/□ were achieved.

Significance and Impact:

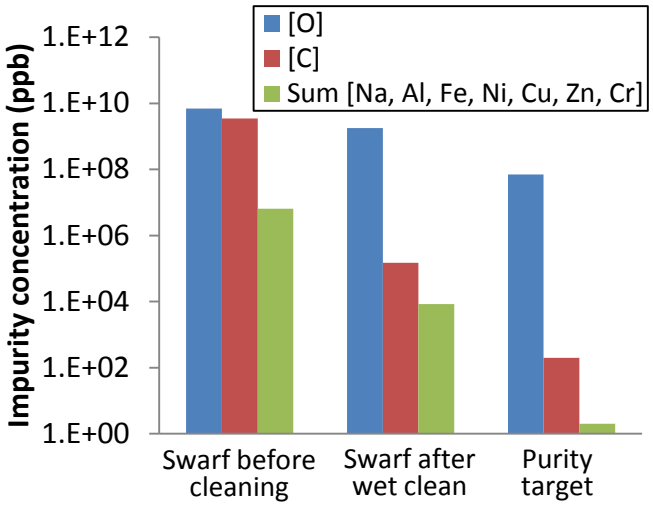
Recycling of silicon from kerf will reduce the embedded energy of silicon feedstock production. Solar cell fabrication with reasonable efficiency using silicon recovered from kerf will be highly cost-effective.

Collaborations:

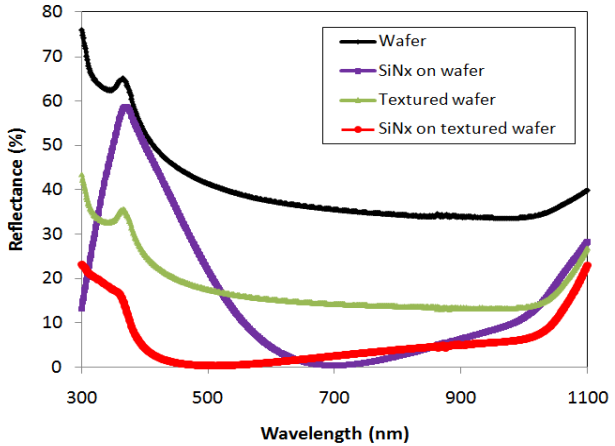
This project has seen excellent collaboration between SunEdison, Washington University in St. Louis (WUStL) , and IIT Bombay, including several visitor exchanges between the three, and a 3-month student internship from IIT Bombay to WUStL and SunEdison, and a student visit from WUStL to IIT Bombay.

Research Details:

- Carbon removal from swarf was done by wet cleaning using chemical solution followed by acidic and thermal oxidation (SunEdison & WUStL).
- The Ni contamination and its gettering in wafers is being studied using Raman spectroscopy, lifetime and ICP-AES techniques. Cr, Al, and Fe will also be studied in the future (IITB & WUStL).
- The following processes were optimized in solar cell fabrication on CCz wafers: saw damage removal, texturing, diffusion, and ARC deposition (IITB & SunEdison).



Impurity concentration in swarf and target values



Reflectance of different surfaces on CCz wafer

Publication: Amruta P. Joshi, Mehul C. Raval, Anil Kottantharayil, Chetan S. Solanki, Inductively Coupled Plasma Atomic Emission Spectroscopy: A bulk analysis and process monitoring technique for silicon solar cell fabrication, 39th IEEE PVSC, Tampa, FL, USA, 2013.

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