

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/\square 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.

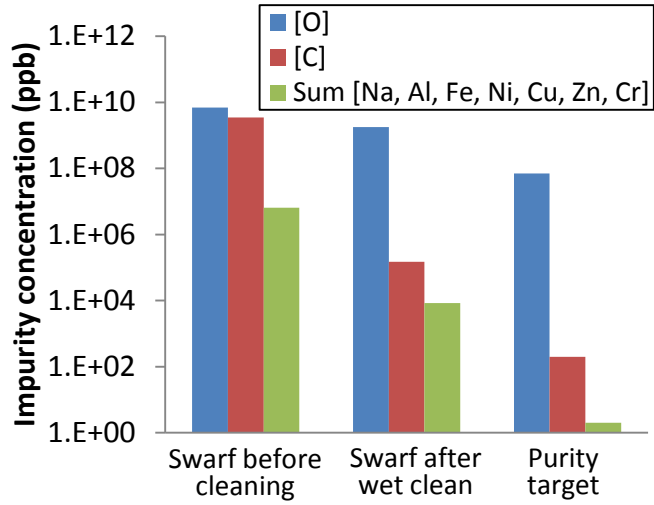
Collaborations:

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.

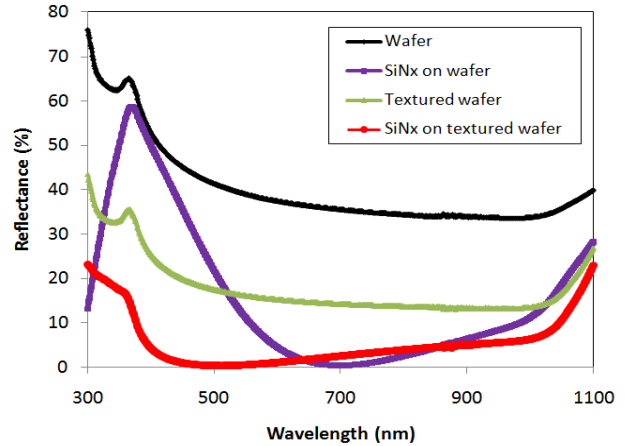
Research Details:

- 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).

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.



Impurity concentration in swarf and target values



Reflectance of different surfaces on CCz wafer

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