



# PV Si Feedstock Evaluation - Application Discussion

## PV Si Feedstock Type (all physical forms\*)

Upgraded Metallurgical Silicon

Modified Siemens Polysilicon

\* Physical forms: chunks, flakes, powders, recycled wafers, ingot croppings, granules

## Application & Technique

Element survey by GDMS

Selected Elements by SIMS  
 Atmospherics: C, O, N, H  
 Dopants: e.g., B, P, Al, As  
 Metals: e.g., Fe, Cu, Ni  
 Other: e.g., Ca

PV Si feedstock refers to the solid silicon that is fed into furnaces that make either rectangular blocks of multi-crystalline Si, cylindrical boules of single crystal Si, or Si ribbon, which are then "shaped" into Si wafers for Si solar cell manufacturing.

PV Si feedstock is itself manufactured in two general methods: (1) a gaseous deposition of Si either onto rods (Siemens or modified Siemens process) or into granules in a Fluidized Bed Reactor, or (2) a thermo-chemical processing of solid metallurgical-grade silicon (typically ~98% pure) into upgraded metallurgical-grade silicon (typically ~6N, or 99.9999%, pure). PV Si feedstock manufactured by the gaseous deposition route has higher purity, but higher cost, compared to the upgraded metallurgical-grade silicon.

An overview of analytical methods to evaluate PV Si feedstock is given in "Analytical Techniques for PV Si Feedstock Evaluation" which was presented as an invited paper at an NREL Si PV Workshop.

EAG offers two methods for evaluating PV Si feedstock in support of R&D, Manufacturing, or 3rd party verification in sales.

Glow Discharge Mass Spectrometry (GDMS) which provides a survey of most elements in the periodic table and which has detection limits that are useful for upgraded metallurgical grade silicon. An international test method SEMI PV1-Q309 for the GDMS measurement has been approved by the SEMI PV Committee.

Secondary Ion Mass Spectrometry (SIMS) which provides better detection limits, precision and accuracy than GDMS, but is too expensive for a survey of the periodic table. SIMS is best used for critical elements, such as, B, P, Al, O, C, N, and Fe in gaseous-deposited PV Si feedstock.

Visit [www.eaglabs.com](http://www.eaglabs.com) (Publications) for more information:

- PV Silicon Impurity Analysis - BR025
- Impurity Analysis of PV Si (Flash Presentation)
- Quantitative Measurement of Dopants (sub-ppba), Oxygen and Carbon (sub-ppma), and Metals (sub-ppma) in PV Si Feedstock and Wafers by SIMS - PS715
- Quality Assurance of Photovoltaic Materials by Direct Sampling High Mass Resolution Glow-Discharge Mass Spectrometry Methods - PS716
- Analytical Techniques for PV Si Feedstock Evaluation - R. S. Hockett - PA118
- SIMS Detection Limits for Selected Impurities in Si Bulk Conditions - AN444
- Uniformity Study of B, Al, P, C, O, Ca and Fe in Upgraded Metallurgical Grade Silicon (UMG-Si) by SIMS - AN452
- Production Support and Process Control of PV Materials by Direct Sampling High-Resolution Glow Discharge Mass Spectrometry Methods - C. Michellon, K. Putyera, M. Kasik, and R. Hockett - PA117



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