



The SEMI International Standards Program brings together industry experts to exchange ideas and develop globally accepted technical standards for manufacturing. SEMI provides a forum for the collaboration essential to move new and existing markets forward efficiently and profitably.

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PV Standards - General

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Photovoltaic Standards at SEMI

Overview

For over 35 years, the SEMI International Standards Program has been well known for developing global consensus standards for the semiconductor industry. Less well-known, but now increasing in visibility, is the long SEMI history of developing PV Standards, leveraging the many similarities that photovoltaic (PV) manufacturing has to that of the semiconductor and FPD industries. The first SEMI Photovoltaic Standard, M6, Specification for Silicon Wafers for Use as Photovoltaic Solar Cells, was published in 1981. With a global infrastructure serving major PV manufacturing regions, PV Standardization activity at SEMI is now taking center stage.

Photovoltaic Standards Committee

The first SEMI Standards Committee specifically dedicated to photovoltaics was formed in 2007, and rapidly developed SEMI PVI, a test method for solar-grade silicon feedstock, and SEMI PV2, guide for PV equipment communication interfaces. There are now over 30 PV Standardization activities underway at SEMI, both in crystalline silicon and thin film cell technologies, and new PV Automation and PV Materials Committees have recently been formed to specifically address standardization topics related to hardware and software automation, materials and test methods.

Committees are now active in **Europe, Japan, North America, and Taiwan**, and a Working Group is forming in **China**. Over 500 technical experts from leading companies in all segments of the photovoltaic supply chain are currently involved in PV Standards efforts at SEMI. Join them in this important effort. Registration is free and only takes a few minutes. Register at www.semi.org/standardsmembership.

Industry Participation is Critical

Momentum is building for the development and widespread adoption of standards in the solar photovoltaic manufacturing industry. The SEMI Standards Program allows companies to collaborate in a precompetitive environment to define the best path to encourage technical innovation and market growth. Companies that actively participate in the development process stay current with industry technology trends, and more importantly, these companies shape the development of the industry.

Topics currently being worked on include:

- Analytical test methods
- Cell and module vibration test method
- Cell appearance and defect detection
- Cell specification template
- Equipment to equipment communication
- Minority carrier lifetime
- Process chemicals and gases
- PV wafer defect metrology
- PV wafer and cell transport carriers
- PV wafer mark and ID
- Silicon wafers used as PV solar cells
- Single substrate tracking
- Solar grade silicon feedstock
- Thin film substrate dimensions
- Transparent conductive oxide

Published SEMI PV Standards

- SEMI PV1 - Test Method for Measuring Trace Elements in Silicon Feedstock for Silicon Solar Cells by High-Mass Resolution Glow Discharge Mass Spectrometry
- SEMI PV2 - Guide for PV Equipment Communication Interfaces (PVECI)
- SEMI PV3 - Guide for High Purity Water Used in Photovoltaic Cell Processing
- SEMI PV4 - Specification for Range of 5th Generation Substrate Sizes for Thin Film Photovoltaic Applications
- SEMI PV5 - Guide for Oxygen (O₂), Bulk, Used In Photovoltaic Applications
- SEMI PV6 - Guide for Argon (Ar), Bulk, Used In Photovoltaic Applications
- SEMI PV7 - Guide for Hydrogen (H₂), Bulk, Used In Photovoltaic Applications
- SEMI PV8 - Guide for Nitrogen (N₂), Bulk, Used In Photovoltaic Applications
- SEMI PV9 - Test Method For Excess Charge Carrier Decay In PV Silicon Materials By Non-Contact Measurements Of Microwave Reflectance After A Short Illumination Pulse
- SEMI PV10 - Test Method For Instrumental Neutron Activation Analysis (INAA) Of Silicon
- SEMI PV11 - Specifications for Hydrofluoric Acid, Used In Photovoltaic Applications
- SEMI PV12 - Specifications for Phosphoric Acid, Used In Photovoltaic Applications
- SEMI PV13 - Test Method for Contactless Excess-Charge-Carrier Recombination Lifetime Measurement in Silicon Wafers, Ingots, and Bricks Using an Eddy-Current Sensor
- SEMI PV14 - Guide For Phosphorus Oxychloride, Used In Photovoltaic Applications
- SEMI PV15 - Test Method for Measuring BRDF Metrics to Monitor the Surface Roughness and Texture of PV Materials
- SEMI PV16 - Specifications for Nitric Acid, Used In Photovoltaic Applications



- SEMI PV17 - Specification for Virgin Silicon Feedstock Materials for Photovoltaic Applications
- SEMI PV18 - Guide for Specifying a Photovoltaic Connector Ribbon
- SEMI PV19 - Guide for Testing Photovoltaic Connector Ribbon Characteristics

Other SEMI Standards Applicable for PV Manufacturing

- SEMI E10 - Specification for Definition and Measurement of Equipment Reliability, Availability, and Maintainability (RAM)
- SEMI F47 - Specification for Semiconductor Processing Equipment Voltage Sag Immunity
- SEMI F108 - Guide for Integration of Liquid Chemical Piping Components for Semiconductor, Flat Panel Display, and Solar Cell Manufacturing Applications
- SEMI M6 - Specification for Silicon Wafers for Use as Photovoltaic Solar Cells
- SEMI M44 - Guide to Conversion Factors for Interstitial Oxygen in Silicon
- SEMI MF391 - Test Method for Minority Carrier Diffusion Length in Extrinsic Semiconductors by Measurement of Steady-State Surface Photovoltage
- SEMI MF1188 - Test Method for Interstitial Oxygen Content of Silicon by Infrared Absorption With Short Baseline
- SEMI MF1619 - Test Method for Measurement of Interstitial Oxygen Content of Silicon Wafers by Infrared Absorption Spectroscopy with p-Polarized Radiation Incident at the Brewster Angle
- SEMI MF1727 - Practice for Detection of Oxidation Induced Defects in Polished Silicon Wafers
- SEMI MF1809 - Guide for Selection and Use of Etching Solutions to Delineate Structural Defects in Silicon
- SEMI S2 - Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment
- SEMI S26 - Environmental, Health, and Safety Guideline for FPD Manufacturing System