



Committee E44 on Solar, Geothermal and Other Alternative Energy Sources

- Formed in 1978
- Meets once a year during November Committee Week
- Current membership of approximately 70
- Jurisdiction over 49 standards
- Published in the Annual Book of ASTM Standards, Volume 12.02
- 3 technical subcommittees: PV, solar thermal, geothermal
- Chairman: George Kelly, BP Solar



ASTM Standards Development Process

- ASTM provides a great deal of support to committees:
 - ASTM Committee Weeks (meeting space)
 - Staff Managers
 - Automated on-line balloting, including ballot item submittals
 - Format and Style manual
 - Template files for standards
 - Editing and publication
- Types of standards:
 - Test methods — produce a test result, esp. numerical
 - Specifications — provide info for purchasing, standardization
 - Guides/Practices — define procedures for functions or operations
 - Terminology — define and standardize technical terms
- Each type of standard has different required and optional sections:
 - Scope, Terminology, Referenced Documents, Apparatus, Test Method, etc.



ASTM Membership and Voting

- Membership: \$75 per year
- <http://www.astm.org>
- Includes voting rights and 1 free volume (CD-ROM or print)
- Members classified as Producers, Users, or General Interest
- Official vote totals are one vote per organization
- Other members from the same organization are non-voting, **however** —
- All members get to vote
- Any negative vote from a non-voting member must still be handled

- Next meeting: **Nov. 17-18 Miami Beach** (ASTM Committee Week)



ASTM Standards Balloting Process

- Two-ballot process for revisions and draft standards:
 - Subcommittee ballot
 - Main committee ballot
- Each committee member has one vote
- All negative votes must include technical justification
- Consensus standards — any negative vote halts document
- Negative votes must be resolved by the subcommittee
 - Persuasive (draft revised)
 - Not related
 - Non-persuasive (ruling must be upheld by 2/3s vote at main committee)
- Comments received during balloting
 - Must be considered by subcommittee at next meeting
- All standards must be re-ballotted every 5 years
 - Automatic withdrawals



Subcommittee E44.05 on Solar Heating and Cooling Sys. & Materials

- 20 standards
- Solar thermal:
 - Solar transmittance & reflectance measurements
 - Cover materials durability
 - Absorber and insulation materials evaluation
 - Performance measurement
 - Installation and service
- Subcommittee essentially inactive since ~1990
- Reballots handled at main committee level
- E44.05 standards still used and referenced, but —
- Revisions/updates very difficult/impossible without active subcommittee.



Subcommittee E44.15 on Geothermal Field Development & Materials

- 7 geothermal standards
- Subcommittee essentially inactive since ~1994
- Similar maintenance/support problems



Subcommittee E44.09 on Photovoltaic Electric Power Conversion

- Current membership: 30
- 23 active standards
- PV measurement:
 - Reference cell calibration
 - Solar simulation
 - Spectral responsivity
 - Cell/Module/Array power measurement
 - Multi-junctions
- Module stress tests
- System testing:
 - Wet insulation integrity
 - Concentrator module/system performance rating



E44.09 Standards

- E772 & E1325 - Solar and PV Terminologies
- E927 - Specification for Solar Simulation
 - Defines classes A,B, & C
 - Spectral irradiance match to reference spectrum
 - Spatial non-uniformity
 - Temporal instability
- E1040 - Reference package specification
 - Standardizes World Photovoltaic Scale (WPVS) package
- E1596 - Module Solar Weathering Test Method
 - References Committee G03 weathering standards
 - Currently under revision, resolving ballot negatives



E44.09 PV Measurement Standards

- E973 - Spectral mismatch determination
- E927 - Cell electrical I-V performance
- E1021 - Spectral responsivity
- E1036 - Module/Array electrical I-V performance
- E1125 - Primary reference cell calibration
- E1362 - Secondary reference cell calibration
- E2236 - Multi-junction I-V and spectral responsivity measurements
- E2527 - Concentrator module/array outdoor performance rating



E1021 Test Method for Spectral Responsivity Measurements

- Referenced by other measurement standards to obtain spectral mismatch
- Can be used for relative or absolute SR
- Comprehensive revision recently passed (2006)
- Used by NIST Gaithersburg for photodiode calibrations



E1125 Test Method for Calibration of Primary Reference Cells

- Direct normal calibration — pyrheliometer
- Calibration can be traceable to World Radiation Reference (WRR)
- Solar spectral irradiance measured coincident with I_{sc}
- Spectral mismatch corrects I_{sc} to reference spectral irradiance
- Multiple points averaged over several days
- Compared with, and is part of, World PV Scale
- No similar standard
- NREL laboratory accreditation



E1036 Test Method for Module/Array Performance

- I-V performance tested against reference cell or optionally, module
- Spectral mismatch correction
- Temperature and irradiance corrections if not “close” ($\pm 2^{\circ}\text{C}$, $\pm 5\%$)
- Polynomial fit to I-V data points to calculated max power point
- NOCT measurement (JPL method)
- Revision currently in ballot
- 2006 Energy Policy Act
- California Energy Commission
- FSEC laboratory accreditation — Florida state solar energy requirement
- NREL laboratory accreditation
- UL 1703 module safety



E2236 Multi-Junction Device Performance

- Series-connected, stacked multi-junction cells and modules
- Extension of E948, E1021, and E1036
- Spectral responsivity of individual cells using light and voltage bias
- Iterative procedure for current balancing
- Needs spectrally adjustable solar simulator in correct wavelength bands
- Spectral irradiance measured, spectral mismatch M calculated
- Repeated until M is 1.00 ± 0.03 for all subcells
- Only way to obtain correct I_{sc} WRT reference spectral irradiance
- No other similar standards
- Used extensively at NREL for III-V multi-junction cells



E2527 Outdoor Concentrator Module/Array Performance Rating

- “Concentrator” defined as greater than 5000 W/m² (5x)
- Measured during rating period:
 - Output power, DC or AC
 - Total irradiance
 - Ambient temperature
 - Wind speed
- Multiple linear regression to rating equation:

$$P = E(a_1 + a_2 \cdot E + a_3 \cdot T_o + a_4 \cdot v_o)$$

- Power rating calculated at 20°C, 4 m/s, 850 W/m²
- No similar standard
- New revision in progress — changes “rating” to “reporting”



WK9920 Specification for Steel Blades for Cut Test — Draft

- Issue — tip radius of steel hacksaw blades used for cut test
- IEC 61215 module qualification, UL 1703 module safety, etc.
- Currently no restrictions
- Radius too large, test always passes
- Radius too small, test always fails
- What is correct range?
- Will specify 0.4 ± 0.05 mm
- How to specify steel for a “hacksaw” blade still to be resolved



E2461 Test Method for Hot Spot Endurance

- Hot spot shading stress test for Si modules
- Old JPL procedure doesn't pick correct cells to stress
- Lab experience that test never causes failures
- New procedure proposed by BP Solar and TUV Europe
- Module I-V curves with each cell shaded in succession
- Four cells selected for two different stresses
- Revision under consideration



Proposed New Project — EVA Gel Content Test Method

- UL proposal
- PV production line test
- ASTM D2765 isn't suitable
- Combination of STR and NREL tests
- No draft — on agenda for Nov. 2008