

CONFERENCE PROGRAMME

TOPIC 2

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(i) = invited

MONDAY, 1 September 2008

ORAL PRESENTATIONS 2AO.1

13:30 – 15:00 **Mono- and Multicrystalline Silicon Cells and Materials, Processing Technology of Wafers, Sheets and Ribbons**
Back-Contact c-Si Solar Cells

Chairpersons:

A. Cuevas
Australian National University, Canberra, Australia

G. Beaucarne
IMEC, Leuven, Belgium

- 2AO.1.1** S. Inoue
Kyocera Solar Europe, Kadan, Czech Republic
T. Sakamoto, M. Komoda, H. Ohwada, K. Fukui & K. Shirasawa
Kyocera, Higashiomi, Japan
High Efficiency Multicrystalline Silicon Back-Contact Solar Cells
- 2AO.1.2** F. Granek, M. Hermle, C. Reichel, J. Benick, O. Schultz & S.W. Glunz
Fraunhofer ISE, Freiburg, Germany
High-Efficiency Back-Junction Back-Contact Silicon Solar Cells Research at Fraunhofer ISE
- 2AO.1.3** N. Mingirulli, S. Trittler, D. Biro & R. Preu
Fraunhofer ISE, Freiburg, Germany
Passivation of Laser-Drilled Via Holes for Emitter-Wrap-Through-Cells
- 2AO.1.4** I.G. Romijn, A.A. Mewe, M.W.P.E. Lamers, A.F. Stassen, E. Kossen, I.J. Bennett, E.E. Bende & A.W. Weeber
ECN, Petten, The Netherlands
An Overview of MWT Cells and Evolution to the ASPIRe Concept: A New Integrated mc-Si Cell and Module Design for High-Efficiencies
- 2AO.1.5** K. Nakamura, M. Kohira, Y. Abiko, T. Isaka, Y. Funakoshi & T. Machida
SHARP, Katsuragi, Nara, Japan
Development of Back Contact Si Solar Cell and Module in Pilot Production Line

- 2AO.1.6** C. Peters, P. Engelhart, J. Mattheis, M. Hlusiak, R. Wade, D. Rychtarik & J.H. Müller
Q-Cells, Bitterfeld-Wolfen, Germany
C. Ulzhöfer & N.-P. Harder
ISFH, Emmerthal, Germany
C. Schmiga & D. Kray
Fraunhofer ISE, Freiburg, Germany
Alba - Development of High-Efficiency Multicrystalline Si EWT Solar Cells for Industrial Fabrication at Q-Cells

ORAL PRESENTATIONS 2AO.2

15:15 – 16:45 **Mono- and Multicrystalline Silicon Cells and Materials, Processing Technology of Wafers, Sheets and Ribbons**
Defects in Crystalline Silicon and Surface Passivation

Chairpersons:

R. Brendel
ISFH, Emmerthal, Germany

B. Sopori (i)
NREL, Golden, USA

- 2AO.2.1** M. Rinio & D. Borchert
Fraunhofer ISE, Gelsenkirchen, Germany
H. Habenicht
Fraunhofer ISE, Freiburg, Germany
T. Buonassisi
MIT, Cambridge, USA
Defect Redistribution by 400 °C Anneal in Typical Ingot Silicon Solar Cells
- 2AO.2.2** B. Lim, K. Bothe & J. Schmidt
ISFH, Emmerthal, Germany
Permanent Deactivation of the Boron-Oxygen Recombination Center in Silicon Solar Cells
- 2AO.2.3** D. Suwito, T. Roth, S. Janz & S.W. Glunz
Fraunhofer ISE, Freiburg, Germany
Detailed Study on the Passivation Mechanism of Six-C1-x for the Solar Cell Rear Side
- 2AO.2.4** S. Miyajima, J. Irikawa, A. Yamada & M. Konagai
Tokyo Institute of Technology, Japan
Al_{1-x}O_x Films Deposited by Plasma Enhanced Chemical Vapor Deposition for Passivation of p-Type Crystalline Silicon
- 2AO.2.5** S. Gatz, H. Plagwitz, B. Terheiden & R. Brendel
ISFH, Emmerthal, Germany
Thermally Stable Surface Passivation by Amorphous Silicon for Screen-Printed Cells
- 2AO.2.6** B. Hoex, M.C.M. van de Sanden & W.M.M. Kessels
Eindhoven University of Technology, The Netherlands
Excellent Passivation of Lightly Doped c-Si and p+-type Emitters by the Negative-Charge-Dielectric Al₂O₃

ORAL PRESENTATIONS 2AO.3

17:00 – 18:30 **Mono- and Multicrystalline Silicon Cells and Materials, Processing Technology of Wafers, Sheets and Ribbons**

Advanced c-Silicon Solar Cell Processing (1)

Chairpersons:

J. Schmidt
ISFH, Emmerthal, Germany

D. Macdonald
Australian National University, Canberra, USA

- 2AO.3.1** V.D. Mihailetchi, G. Coletti, Y. Komatsu, L.J. Geerligs & A.W. Weeber
ECN, Petten, The Netherlands
R. Kvande & L. Arnberg
Norwegian University of Science and Technology, Trondheim, Norway
K. Wambach & C. Knopf
Deutsche Solar, Freiberg, Germany
R. Kopecek
ISC Konstanz, Germany
Large Area Screen Printed N-Type Base Silicon Solar Cells With Efficiency Exceeding 18%
- 2AO.3.2** V. Gazuz, M. Mühlbauer & R. Auer
ZAE Bayern, Erlangen, Germany
Thin (90µm) Multicrystalline Si Solar Cell With 15% Efficiency by Al-Bonding to Glass
- 2AO.3.3** P. Choulat, G. Agostinelli, Y. Ma, J. John & G. Beaucarne
IMEC, Leuven, Belgium
H. Nagel
SCHOTT Solar, Alzenau, Germany
15.6% Industrial Type PERC Solar Cell on Low Quality 140µm Thick EFG Substrate
- 2AO.3.4** M.N. van den Donker, P.A.M. Wijnen, S. Krantz, V. Sjarheyeva & M. Fleuster
Solland Solar, Heerlen, The Netherlands
I.G. Romijn, A.A. Mewe, M.W.P.E. Lamers, A.F. Stassen, E.E. Bende & A.W. Weeber
ECN, Petten, The Netherlands
P. van Eijk, H. Kerp & K. Albertsen
Ferro Electronic Material Systems, Uden, The Netherlands
The StarFire Project: Towards In-Line Mass Production of Thin High Efficiency Back-Contacted Multicrystalline Silicon Solar Cells
- 2AO.3.5** C. Ulzhöfer, B. Wolpensinger & J. Schmidt
ISFH, Emmerthal, Germany
Understanding the Lifetime Evolution in N-Type mc-Si During Gettering and Hydrogenation
- 2AO.3.6** M. Zimmer, C. Hepfinger, E. Kirchgässner & J. Rentsch
Fraunhofer ISE, Freiburg, Germany
Spectroscopical Inline Analysis of Wet Chemical Processes

TUESDAY, 2 September 2008

PLENARY SESSION 2BP.3

11:30-12:10 **Wafer-Based Silicon Solar Cells and Materials Technology**

Si Feedstock Issues

Chairpersons:

A. Goetzberger
Fraunhofer ISE, Freiburg, Germany

S. Pizzini
University of Milano-Bicocca, Italy

- 2BP.3.1** K. Peter
ISC Konstanz, Germany
A.-K. Soiland & E. Enebakk
Elkem Solar, Kristiansand, Norway
Future Potential for SoG-Si Feedstock from Metallurgical Process Route
- 2BP.3.2** D.H. Macdonald & A. Cuevas
The Australian National University, Canberra, Australia
L.J. Geerligs
ECN, Petten, The Netherlands
Carrier Lifetime Studies of Strongly Compensated p-Type Czochralski Silicon

ORAL PRESENTATIONS 2BO.1

13:30 – 15:00 **Silicon Feedstock, Crystallisation and Wafering (1)**

Chairpersons:

H. Aulich
PV Silicon, Erfurt, Germany

T. Bruton
NaREC, Blyth, United Kingdom

- 2BO.1.1** W. Osborne, S. Nova, R. Reis, G. Zeininger, W. Stupin & P. Ege
REC Silicon, Moses Lake, USA
Commercial Process for High Quality Granular Polycrystalline Silicon for Efficient Low-Cost PV Application
- 2BO.1.2** K. Hesse & E. Schindlbeck
Wacker Chemie, Burghausen, Germany
Silicon Feedstock - Factors for Differentiation
- 2BO.1.3** K. Wambach, S. Schlenker, A. Müller & K. Werzner
Deutsche Solar, Freiberg, Germany
Recycling of Silicon, Environmental Footprints and Economics

- 2BO.1.4** J. Kraiem & R. Einhaus
Apollon Solar, Lyon, France
F. Lissalde
Cyberstar, Echiroles, France
N. Enjalbert & R. Monna
CEA, Grenoble, France
Innovative Crystallisation of Multi-Crystalline Silicon Ingots from Different Types of Silicon Feedstock
- 2BO.1.5** T. Kaden, S. Schönwälder, D. Kreißner-Kiel & H.J. Möller
TU Bergakademie, Freiberg, Germany
B. Gründig-Wendrock & R. Lüdemann
Solar World Innovations, Freiberg, Germany
Incorporation and Distribution of Impurities in mc-Si Ingots of Increased Mass and Reduced Process Time: Simulations and Measurements
- 2BO.1.6** B. Birkmann, S. Günther, F. Mosel, M. Müller, I. Westram & A. Seidl
WACKER SCHOTT Solar, Alzenau, Germany
Growth of 200 Micron Thin EFG Dodecagonal Tubes: Benefit of Numerical Simulation for Process Optimization

ORAL PRESENTATIONS 2BO.2

15:15 – 16:45 Silicon Feedstock, Crystallisation and Wafering (2)

Chairpersons:

- K. Hesse
Wacker Chemie, Burghausen, Germany
- A. Slaoui
CNRS-InESS, Strasbourg, France
- 2BO.2.1** K. Nakajima, K. Fujiwara, K. Kutsukake & N. Usami
Tohoku University, Sendai, Japan
S. Okamoto
SHARP, Katsuragi-shi, Nara, Japan
Growth of High-Quality Si Multicrystals Using Dendritic Casting Method and Mechanism to Obtain High-Quality Crystals With Low Defects
- 2BO.2.2** C. Martin, C. Ndzogha & G. Rancoule
Vesuvius, Feignies, France
Development of Various Crucible Coating Concepts for Crystallization of Multicrystalline Silicon Ingots
- 2BO.2.3** F. Henley, A. Lamm, S. Kang, Z. Liu & L. Tian
Silicon Genesis Corporation, San Jose, USA
Direct Film Transfer (DFT) Technology for Kerf-Free Silicon Wafering
- 2BO.2.4** A.K. Bakshi & Y. Boussant-Roux
Saint-Gobain High Performance Materials, Northboro MA, USA
L. Québatte & P.M. Nasch
Applied Materials Switzerland, Cheseaux-sur-Lausanne, Switzerland
A. Popa
Saint-Gobain CREE, Cavaillon, France
Influence of Shape and Size of Silicon Carbide Particles on Wire Saw Cutting Efficiency

- 2BO.2.5** O. Anspach, A. Stabel & F.-W. Schulze
PV Silicon, Erfurt, Germany
A. Lawrenz, S. Riesner & R. Porytsky
SolarZentrum, Erfurt, Germany
Investigations on Single Wire Cuts in Silicon
- 2BO.2.6** C. Bierwisch, B. Weber, R. Kübler, M. Moseler & G. Kleer
Fraunhofer IWM, Freiburg, Germany
Contact Regimes in the Wire Sawing Process: Explicit 3D Modeling of Fluid Dynamics in PEG/SiC Slurry Under High Shear Rates

ORAL PRESENTATIONS 2BO.3

17:00 – 18:30 Wafer-Based Silicon Solar Cells and Materials Technology

Industrial Processing Development

Chairpersons:

- J. Szlufcik
Photovoltech, Tienen, Belgium
- P. Malbranche
CEA-INES, Le Bourget du Lac, France
- 2BO.3.1** D. Kray, K. Mayer, T. Orellana, M. Schumann & S.W. Glunz
Fraunhofer ISE, Freiburg, Germany
A New Approach to Combine Cleaning and Texturing of Wire-Sawn Wafers
- 2BO.3.2** H. Yamatsugu, S. Goma, S. Kidoguchi, R. Oishi, K. Yoshida, K. Yano & H. Taniguchi
SHARP, Toyama, Japan
New Wafer Technology for Crystalline Silicon Solar Cell
- 2BO.3.3** V. Hoffmann, K. Petter, J. Djordjevic-Reiss & M. Bauer
Q-Cells, Bitterfeld-Wolfen, Germany
E. Enebakk, J.T. Hakedal & R. Tronstad
Elkem Solar, Kristiansand, Norway
First Results on Industrialization of Elkem Solar Silicon at Q-Cells AG
- 2BO.3.4** A. Ebong, D. Kim & A. Rohatgi
Georgia Institute of Technology, Atlanta, USA
Comprehensive Study of Ag Electroplating Baths With Light Induced Plating of Silver on Screen-Printed Contacts for High Efficiency Silicon Solar Cells
- 2BO.3.5** S. Rein, A. Krieg, A. Weil, G. Emanuel, A. Grohe & R. Preu
Fraunhofer ISE, Freiburg, Germany
Single Wafer Tracking in PV Production Lines
- 2BO.3.6** S. Hopman, A. Fell, K. Mayer, M. Mesec, G.P. Willeke & D. Kray
Fraunhofer ISE, Freiburg, Germany
First Results of Wafering With Laser Chemical Processing

THURSDAY, 4 September 2008

PLENARY SESSION 2DP.2

10:30 – 12:10 **Wafer-Based Silicon Solar Cells and Materials Technology**

Crystalline Silicon Solar Cells

Chairpersons:

R. Swanson
Sunpower, San Jose, USA

A. Luque
UPM, Madrid, Spain

2DP.2.1 G. Beaucarne, J. John, P. Choulat & Y. Ma
IMEC, Leuven, Belgium
R. Russel
BP Solar España, Madrid, Spain
I.G. Romijn & A.W. Weeber
ECN, Petten, The Netherlands
M. Hofmann & R. Preu
Fraunhofer ISE, Freiburg, Germany
A. Slaoui
InESS, Strasbourg, France
N. Le Quang & O. Nichiporuk
PHOTOWATT International, Bourgoin-Jallieu, France
C. del Cañizo & A.C. Pan
UPM, Madrid, Spain
H.J. Solheim & J. Evju
REC Scancell, Narvik, Norway
H. Nagel
SCHOTT Solar, Alzenau, Germany
B. Bitnar, M. Heemeier & T. Weber
SolarWorld, Freiberg, Germany
B. Raabe, H. Haverkamp & G. Hahn
University of Konstanz, Germany
Solar Cell Process Development in the European Integrated Project CrystalClear

2DP.2.2 S. Hudelson, Y.S. Lee, K. Hartman & T. Buonassisi
MIT, Cambridge, USA
M.A. Marcus
Lawrence Berkeley National Laboratory, USA
B. Lai, S. Vogt & Z. Cai
Argonne National Laboratory, USA
Mitigating the "Iron Problem" in Crystalline Silicon Solar Cells

2DP.2.3 M. Kasemann, M.C. Schubert, W. Kwapil, M. The, B. Walter, J. Giesecke, S. Kontermann, W. Warta & S.W. Glunz
Fraunhofer ISE, Freiburg, Germany
B. Michl & H. Nagel
SCHOTT Solar, Alzenau, Germany
P. Würfel
University of Karlsruhe, Germany
Y. Augarten, H. Kampwerth, E. Pink, R.A. Bardos & T. Trupke
University of NSW, Sydney, Australia
J.-M. Wagner, J. Bauer, A. Lotnyk, H. Blumtritt & O. Breitenstein
Max-Planck-Institut, Halle, Germany
A. Schütt, J. Carstensen & H. Föll
University of Kiel, Germany
Progress in Silicon Solar Cell Characterization With Infrared Imaging Methods

2DP.2.4 J. Schmidt, A. Merkle & R. Brendel
ISFH, Emmerthal, Germany
B. Hoex, M.C.M. van de Sanden & W.M.M. Kessels
Eindhoven University of Technology, The Netherlands
Progress in the Surface Passivation of Silicon Solar Cells

2DP.2.5 C. Schmiga, O. Schultz & S.W. Glunz
Fraunhofer ISE, Freiburg, Germany
Towards 20% Efficient n-Type Silicon Solar Cells With Screen-Printed Aluminium-Alloyed Rear Emitter

ORAL PRESENTATIONS 2DO.1

13:30 – 15:00 **Mono- and Multicrystalline Silicon Cells and Materials, Processing Technology of Wafers, Sheets and Ribbons**
Heterojunction Silicon Solar Cells and Solar Grade Silicon

Chairpersons:

P. Basore
Renewable Energy Corporation, San Mateo, USA

A. Baccini
Applied Materials Baccini, San Biagio di Callalta, Italy

2DO.1.1 H. Kanno, S. Taira, Y. Tsunomura, T. Baba, M. Taguchi, Y. Yoshimine, T. Kinoshita, H. Sakata, E. Maruyama & M. Tanaka
SANYO Electric, Kobe, Japan
Over 22% Efficient Hit Solar Cell

2DO.1.2 S. Olibert, E. Vallat-Sauvain, L. Fesquet, J. Damon-Lacoste & C. Ballif
University of Neuchâtel, Switzerland
S. Monachon & A. Hessler-Wyser
EPFL, Lausanne, Switzerland
Textured Silicon Heterojunction Solar Cells With Over 700mV Open-Circuit Voltage Studied by Transmission Electron Microscopy

2DO.1.3 T. Koida, H. Sai, H. Fujiwara & M. Kondo
AIST, Ibaraki, Japan
Improved Spectral Sensitivity in Si-Based Solar Cells by High-Mobility Hydrogen-Doped In₂O₃ Transparent Conductive Oxide

- 2DO.1.4** P. Borden & L. Xu
Applied Materials, Santa Clara, USA
S.W. Glunz, O. Schultz & D. Psych
Fraunhofer ISE, Freiburg, Germany
Polysilicon Tunnel Junctions as Alternates for Diffused Junctions
- 2DO.1.5** J. Libal, S. Novaglia, M. Acciarri & S. Binetti
University of Milano-Bicocca, Italy
R. Kopecek & R. Petres
ISC Konstanz, Germany
O. Prokopenko
JSC Pillar, Kiev, Ukraine
Study of Compensation Effects in CZ-Silicon Grown from Solar Grade Silicon Feedstock
- 2DO.1.6** S. Martinuzzi & I. Perichaud
University of Marseilles, France
J. Degoulange & C. Trassy
CNRS, Grenoble, France
n-Type vs. p-Type mc-Si Wafers from the Metallurgical Route

ORAL PRESENTATIONS 2DO.2

15:15 – 16:45 Mono- and Multicrystalline Silicon Cells and Materials, Processing Technology of Wafers, Sheets and Ribbons

Characterisation

Chairpersons:

W. Warta
Fraunhofer ISE, Freiburg, Germany

T. Buonassisi
MIT, Cambridge, USA

- 2DO.2.1** R.A. Sinton
Sinton Consulting, Boulder, USA
Contactless Electroluminescence for Shunt Value Measurement in Solar Cells
- 2DO.2.2** H. Mäckel, S. Sánchez, C. Vázquez, I. Sanchez & M.A. Vázquez
Isofotón, Málaga, Spain
D.M. Cambre, C. Zaldo & J.M. Albella
Instituto de Ciencia de Materials de Madrid, Spain
Characterisation of Monocrystalline Silicon Texture Using Optical Reflectance Patterns
- 2DO.2.3** J.-M. Wagner, J. Bauer, A. Lotnyk & O. Breitenstein
Max-Planck-Institut, Halle, Germany
Pre-Breakdown Mechanisms in Multicrystalline Silicon Solar Cells

- 2DO.2.4** P. Gundel & W. Warta
Fraunhofer ISE, Freiburg, Germany
M.C. Schubert
University of Freiburg, Germany
M. Allardt
Technical University of Dresden, Germany
Analysis of the Physical Origin of Trap Centres and Their Effect on Solar Cells
- 2DO.2.5** B. Michl & H. Nagel
SCHOTT Solar, Alzenau, Germany
M. Kasemann, J. Giesecke, S. Kontermann, M. Glatthaar, S. Rein & W. Warta
Fraunhofer ISE, Freiburg, Germany
A. Schütt, J. Carstensen & H. Föll
University of Kiel, Germany
Application of Luminescence Imaging Based Series Resistance Measurement Methods in an Industrial Environment
- 2DO.2.6** G. Hahn & A. Helfricht
University of Konstanz, Germany
M. Hofmann
Fraunhofer ISE, Freiburg, Germany
N.J.C.M. van der Borg & A.W. Weeber
ECN, Petten, The Netherlands
G. Beaucarne
IMEC, Leuven, Belgium
S. Bagus & H. Nagel
SCHOTT Solar, Alzenau, Germany
N. Le Quang & O. Nichiporuk
PHOTOWATT International, Bourgoin-Jallieu, France
I. Vincueria
BP Solar, Madrid, Spain
M. Brochs
REC Scancell, Narvik, Norway
IV Measurements of mc-Si Solar Cells: Comparison of Results From Institute and Industry Partners Within the EU CrystalClear Project

ORAL PRESENTATIONS 2DO.3

17:00 – 18:30 Mono- and Multicrystalline Silicon Cells and Materials, Processing Technology of Wafers, Sheets and Ribbons

Advanced c-Silicon Solar Cell Processing (2)

Chairpersons:

R. Preu
Fraunhofer ISE, Freiburg, Germany

F. Ferrazza
Eni, Rome, Italy

- 2DO.3.1** J. Rentsch
Fraunhofer ISE, Freiburg, Germany
D. Decker & H. Schlemm
Roth & Rau, Hohenstein-Ernstthal, Germany
Plasma Cluster Processing for Advanced Solar Cell Manufacturing

- 2DO.3.2** Y. Ma, P. Choulat, G. Agostinelli, J. John, X. Loozen & G. Beaucarne
IMEC, Leuven, Belgium
Industrial-Type PERC Solar Cell: Towards 80 Micron Thickness
- 2DO.3.3** A.D. Shirazi, H. Haverkamp, B. Raabe, F. Book & G. Hahn
University of Konstanz, Germany
Selective Emitter for Industrial Solar Cell Production: A Wet Chemical Approach Using a Single Diffusion Process
- 2DO.3.4** X. Loozen, G. Agostinelli, J. John, P. Choulat, Y. Ma, H.F. Dekkers & G. Beaucarne
IMEC, Leuven, Belgium
Effectiveness of Atomic and Molecular Hydrogen Passivation of a Silicon/Silicon Oxide Interface With a Deposited Oxide
- 2DO.3.5** S. Hermann, T. Neubert, B. Wolpensinger, N.-P. Harder & R. Brendel
ISFH, Emmerthal, Germany
Process Characterisation of Picosecond Laser Ablation of SiO₂ and SiN_x on Planar and Textured Surfaces
- 2DO.3.6** invited

VISUAL PRESENTATIONS

VISUAL PRESENTATIONS 2CV.3

13:30 – 15:00 Silicon Feedstock, Crystallisation and Wafering

Detailed information on Session 2CV.3.1 – 2CV.3.53 is presented in the section entitled 'Visual Presentations'.

VISUAL PRESENTATIONS 2CV.4

15:15 – 16:45 Mono- and Multicrystalline Silicon Cells and Materials, Processing Technology of Wafers, Sheets and Ribbons

Detailed information on Session 2CV.4.1 -2CV.4.73 is presented in the section entitled 'Visual Presentations'.

VISUAL PRESENTATIONS 2CV.5

17:00 – 18:30 Mono- and Multicrystalline Silicon Cells and Materials, Processing Technology of Wafers, Sheets and Ribbons

Detailed information on Session 2CV.5.1 – 2CV.2.80 is presented in the section entitled 'Visual Presentations'.

VISUAL PRESENTATIONS 2DV.1

**08:30 – 10:10 Mono- and Multicrystalline Silicon Cells and Materials, Processing Technology of Wafers, Sheets and Ribbons
Handling Issues and Manufacturing Automation**

Detailed information on Session 2DV.1.1 – 2DV.1.69 is presented in the section entitled 'Visual Presentations'.