

# Sinton Consulting, Inc.

## Detailed List of Lifetime and SunsVoc Papers

The list below contains papers that use Sinton equipment or provide relevant theory. The papers are sorted by year of publication and then alphabetically by first author. There is a form at the bottom of the page where you can add references we may have missed.

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## 2006

- M.D. Abbott, J.E. Cotter, T. Trupke, K. Fisher, and R.A. Bardos, "Application of Photoluminescence To High-Efficiency Silicon Solar Cell Fabrication," 4th World Conference on Photovoltaic Energy Conversion, pp. 1211-1214, May 2006.
- P.P. Altermatt, H. Plagwitz, R. Bock, J. Schmidt, R. Brendel, M.J. Kerr, and A. Cuevas, "The Surface Recombination Velocity at Boron-Doped Emitters: Comparison Between Various Passivation Techniques," 21st European Photovoltaic Solar Energy Conference, pp. 647-650, Sep 2006.
- M. Ametowobla, J.R. Köhler, A. Esturo-Bretón, and J.H. Werner, "Characterization of a Laser Doping Process for Crystalline Silicon Solar Cells," 21st European Photovoltaic Solar Energy Conference, pp. 1440-1443, Sep 2006.
- N. Arifuku, H. Jin, M.S. Jeon, M. Dhamrin, M. Suda, T. Saitoh, and K. Kamisako, "Characteristic Evaluation of SiNx:H Films Passivation Effect on Ga-Doped Multi-Crystalline Silicon Wafers," 4th World Conference on Photovoltaic Energy Conversion, pp. 1287-1290, May 2006.
- D. Barakel, M. Gauthier, S. Martinuzzi, N. Le Quang, O. Palais, G. Goaer, and I. Périchaud, "Minority Carrier Bulk Lifetime Through a Large Multicrystalline Silicon Ingot and Related Solar Cells Properties," 21st European Photovoltaic Solar Energy Conference, pp. 1111-1114, Sep 2006.
- R.A. Bardos, T. Trupke, M.C. Schubert, and T. Roth, "Trapping artifacts in quasi-steady-state photoluminescence and photoconductance lifetime measurements on silicon wafers," Applied Physics Letters, vol. 88, no. 5, Jan 2006.
- S. Bastide, R. Tena-Zaera, C. Lévy-Clément, D. Barakel, O. Palais, and S. Martinuzzi, "Photo-Electrochemical Texturisation of N-Type Crystalline Si," 21st European Photovoltaic Solar Energy Conference, pp. 911-914, Sep 2006.
- D.L. Bätzner, K. Hanton, A. Li, and A. Cuevas, "Investigation of the Co-Firing Process for Contact Formation in Screen Printed Silicon Solar Cells," 21st European Photovoltaic Solar Energy Conference, pp. 807-810, Sep 2006.
- D. Biro, R. Preu, S.W. Glunz, S. Rein, J. Rentsch, G. Emanuel, I. Brucker, T. Faasch, C. Faller, G. Willeke, and J. Luther, "Pv-Tec: Photovoltaic Technology Evaluation Center - Design and Implementation of a Production Research Unit," 21st European Photovoltaic Solar Energy Conference, pp. 621-624, Sep 2006.
- E. Bobeico, L. Lancellotti, P. Morvillo, and F. Roca, "Metal Grid Optimization of C-Si Solar Cells for Concentrating Systems," 21st European Photovoltaic Solar Energy Conference, pp. 509-512, Sep 2006.
- K. Bothe, and J. Schmidt, "Electronically activated boron-oxygen-related recombination centers in crystalline silicon," Journal of Applied Physics, vol. 99, no. 1, Jan 2006.

- S. Bowden, U.K. Das, S.S. Hegedus, and R.W. Birkmire, "Carrier Lifetime as a Developmental and Diagnostic Tool in Silicon Heterojunction Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 1295-1298, May 2006.
- T. Buonassisi, A. M. Lorenz, and G. J. Tarnowski, "Nature, Impact, and Remediation of the Principal Lifetime-Limiting Defects in String Ribbon Material," 21st European Photovoltaic Solar Energy Conference, pp. 1505-1508, Sep 2006.
- H. Charifi, A. Zerga, A. Slaoui, J.-C. Muller, and J.P. Stoquert, "Properties of ECR-PECVD Hydrogenated Amorphous Silicon Nitride Films for Passivation Purpose," 21st European Photovoltaic Solar Energy Conference, pp. 846-849, Sep 2006.
- F.W. Chen, J.E. Cotter, T. Trupke, and R.A. Bardos, "Characterization of PECVD Silicon Nitride Passivation with Photoluminescence Imaging," 4th World Conference on Photovoltaic Energy Conversion, pp. 1373-1376, May 2006.
- F.W. Chen, T.A. Li, and J.E. Cotter, "Pecvd Silicon Nitride Surface Passivation for High-Efficiency N-Type Silicon Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 1020-1023, May 2006.
- B. Chhabra, S. Jacobs, and C.B. Honsberg, "Suns-Voc and Minority Carrier Lifetime Measurements of III-V Tandem Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 791-794, May 2006.
- J. Coello, C. del Cañizo, and A. Luque, "Review on Bifacial Solar Cell Structures for Industrialization," 21st European Photovoltaic Solar Energy Conference, pp. 1358-1361, Sep 2006.
- G. Coletti, L. J. Geerligs, P. Manshanden, S. Riepe, W. Warta, J. Arumughan, and R. Kopecek, "Multicrystalline Float Zone Silicon with Fe and Mo Impurities: Solar Cell Process and Lifetime Studies," 21st European Photovoltaic Solar Energy Conference, pp. 1277-1280, Sep 2006.
- G. Coletti, C.L. Mulder, G. Galbiati, and L.J. Geerligs, "Reduced Effect of B-O Degradation on Multicrystalline Silicon Wafers," 21st European Photovoltaic Solar Energy Conference, pp. 1515-1518, Sep 2006.
- E. Cornagliotti, G. Agostinelli, J. van der Heide, N.E. Posthuma, G. Beaucarne, and J. Poortmans, "Extension of QSSPC Lifetime Measurement To Germanium Samples," 4th World Conference on Photovoltaic Energy Conversion, pp. 1869-1872, May 2006.
- U. Coscia, G. Ambrosone, P. Rava, P. Rivolo, F. Ferrazza, L. Serenelli, S. De Iuliis, and M. Tucci, "Surface Passivation of p- and n- Type Crystalline Silicon Wafers by  $\text{Si}_x\text{N}_y/\text{SiC}_x\text{H}_y$  Layers," 21st European Photovoltaic Solar Energy Conference, pp. 1623-1626, Sep 2006.
- P.J. Cousins, and J.E. Cotter, "Minimizing lifetime degradation associated with thermal oxidation of upright randomly textured silicon surfaces," *Solar Energy Materials and Solar Cells*, vol. 90, no. 2, pp. 228-240, Jan 2006.

S. Daliento, L. Mele, L. Lancellotti, P. Morvillo, E. Bobeico, and F.R.L. Pirozzi, "Performances Characterization of Concentration Solar Cells by Means of I-V and Lifetime Measurements Made with the QSSPC Technique," 21st European Photovoltaic Solar Energy Conference, pp. 1334-1337, Sep 2006.

S. De Wolf, and G. Beaucarne, "Surface passivation properties of boron-doped plasma-enhanced chemical vapor deposited hydrogenated amorphous silicon films on p-type crystalline Si substrates," Applied Physics Letters, vol. 88, no. 2, Jan 2006.

S. De Wolf, and M. Kondo, "Surface Passivation Properties of Stacked Doped PECVD A-Si:H Layers for Hetero-Structure C-Si Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 1469-1472, May 2006.

M. Dhamrin, T. Saitoh, K. Kamisako, and I. Yamaga, "Realization of Extremely High Diffusion Lengths in Low-Resistivity B-Doped Multicrystalline Solar Cells," 21st European Photovoltaic Solar Energy Conference, pp. 870-873, Sep 2006.

S.K. Dhungel, J. Yoo, K. Kim, S. Ghosh, S. Jung, and J. Yi, "Process Induced Variation in the Measurement of Minority Carrier Lifetime of Silicon in Solar Cells Fabrication," 21st European Photovoltaic Solar Energy Conference, pp. 899-902, Sep 2006.

S. Diez, S. Rein, T. Roth, and S. W. Glunz, "Analyzing Defects by Temperature- and Injection-Dependent Lifetime Measurements," 21st European Photovoltaic Solar Energy Conference, pp. 1215-1218, Sep 2006.

P. Engelhart, N.-P. Harder, A. Merkle, R. Grischke, R. Meyer, and R. Brendel, "Rise: 21.5% Efficient Back Junction Silicon Solar Cell with Laser Technology as a Key Processing Tool," 4th World Conference on Photovoltaic Energy Conversion, pp. 900-903, May 2006.

R. Ferre, I. Martín, M. Vetter, D. Baetzner, J. Tan, A. Cuevas, and R. Alcubilla, "Surface and Emitter Passivation of Crystalline Silicon by Amorphous Silicon Carbide: Evolution with Annealing," 21st European Photovoltaic Solar Energy Conference, pp. 919-922, Sep 2006.

F. Granek, M. Hermle, B. Fleischhauer, A. Grohe, O. Schultz, S.W. Glunz, and G. Willeke, "Optimisation of Laser-Fired Aluminium Emitters for High Efficiency N-Type Si Solar Cells," 21st European Photovoltaic Solar Energy Conference, pp. 777-780, Sep 2006.

A. Grohe, A. Knorz, M. Alemán, C. Harmel, S.W. Glunz, R. Preu, and G.P. Willeke, "Novel Low Temperature Front Side Metallisation Scheme Using Selective Laser Ablation of Anti Reflection Coatings and Electroless Nickel Plating," 21st European Photovoltaic Solar Energy Conference, pp. 750-753, Sep 2006.

J. Hao, K.J. Weber, and A.W. Blakers, "Depassivation of Si-SiO<sub>2</sub> Interface Following Rapid Thermal Annealing," 4th World Conference on Photovoltaic Energy Conversion, pp. 1078-1080, May 2006.

J. Hao, K.J. Weber, and A.W. Blakers, "Passivation of LPCVD Nitride Silicon Stacks by Atomic H," 4th World Conference on Photovoltaic Energy Conversion, pp. 1000-1003,

May 2006.

A. Herguth, G. Schubert, M. Kaes, and G. Hahn, "Avoiding Boron-Oxygen Related Degradation in Highly Boron Doped Cz Silicon," 21st European Photovoltaic Solar Energy Conference, pp. 530-533, Sep 2006.

M.M. Hilali, K. Nakayashiki, C. Khadilkar, R.C. Reedy, A. Rohatgi, A. Shaikh, S. Kim, and S. Sridharan, "Effect of Ag particle size in thick-film Ag paste on the electrical and physical properties of screen printed contacts and silicon solar cells," Journal of the Electrochemical Society, vol. 153, no. 1, pp. A5-A11, 2006.

Y. Hishikawa, "Precise Performance Measurement of High-Efficiency Crystalline Silicon Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 1279-1282, May 2006.

B. Hoex, W.M.M. Kessels, M.D. Bijker, and M.C.M. van de Sanden, "Excellent Surface Passivation by Hydrogenated Amorphous Silicon Deposited at Rates  $> 1$  Nm/S by the Expanding Thermal Plasma Technique," 21st European Photovoltaic Solar Energy Conference, pp. 435-438, Sep 2006.

B. Hoex, F.J.J. Peeters, M. Creatore, M.D. Bijker, W.M.M. Kessels, and M.C.M. van de Sanden, "Good Surface Passivation of C-Si by High Rate Plasma Deposited Silicon Oxide," 4th World Conference on Photovoltaic Energy Conversion, pp. 1134-1137, May 2006.

B. Hoex, F.J.J. Peeters, A.J. van Erven, M.D. Bijker, W.M.M. Kessels, and M.C.M. van de Sanden, "High-Quality Surface Passivation Obtained by High-Rate Deposited Silicon Nitride, Silicon Dioxide and Amorphous Silicon Using the Versatile Expanding Thermal Plasma Technique," 4th World Conference on Photovoltaic Energy Conversion, pp. 1036-1039, May 2006.

M. Hofmann, S. Glunz, R. Preu, and G. Willeke, "21%-Efficient Silicon Solar Cells Using Amorphous Silicon Rear Side Passivation," 21st European Photovoltaic Solar Energy Conference, pp. 609-612, Sep 2006.

J. J. Tan, A. Cuevas, D. Macdonald, D. Bätzner, H. Mäckel, and K. Hanton, "Measurement and Optimization of the Recombination Current of P+ Aluminium Doped Regions," 21st European Photovoltaic Solar Energy Conference, pp. 1377-1380, Sep 2006.

K. Kiefer, W. Warta, J. Hohl-Ebinger, W. Herrmann, and N. Heisterkamp, "Optimisation of the Power Measurement of Silicon Photovoltaic Modules," 21st European Photovoltaic Solar Energy Conference, pp. 2493-2496, Sep 2006.

J. Kraiem, P. Papet, O. Nichiporuk, S. Amtblan, J.F. Lelievre, S. Quiozola, A. Fave, A. Kaminski, P.J. Ribeyron, C. Jaussaud, and M. Lemiti, "Elit Process: Epitaxial Layers for Interdigitated Back Contacts Solar Cells Transferred," 4th World Conference on Photovoltaic Energy Conversion, pp. 1126-1129, May 2006.

K. Lauer, M. Ghosh, A. Lawrenz, and S. Dauwe, "Minority Carrier Lifetime, Trap Density and Interstitial Iron Content in Multicrystalline Silicon Raw Wafers Versus Ingot

Position," 21st European Photovoltaic Solar Energy Conference, pp. 1362-1365, Sep 2006.

J.Y. Lee, and S.W. Glunz, "Investigation of various surface passivation schemes for silicon solar cells," *Solar Energy Materials and Solar Cells*, vol. 90, no. 1, pp. 82-92, Jan 2006.

H. Mäckel, and A. Cuevas, "Unveiling the Injection-Dependence of the Diffusion Length Via the Spectral Response of the Voltage of Silicon Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 908-911, May 2006.

I. Martín, D. Muñoz, C. Voz, M. Vetter, R. Alcubilla, J. Damon-Lacoste, P.R.I. Cabarrocas, F. Villar, J. Bertomeu, and J. Andreu, "Comparison of (n+) a-Si:H / (p) C-Si Heterojunction Emitters Using a-Si:H Films Deposited by PECVD Or HWCVD," 4th World Conference on Photovoltaic Energy Conversion, pp. 1091-1094, May 2006.

K. McLean, C. Morrow, and D. Macdonald, "Activation Energy for the Hydrogenation of Iron in P-Type Crystalline Silicon Wafers," 4th World Conference on Photovoltaic Energy Conversion, pp. 1122-1125, May 2006.

T. Nagashima, K. Hokoi, K. Okumura, and M. Yamaguchi, "Surface Passivation for Germanium and Silicon Back Contact Type Photovoltaic Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 655-658, May 2006.

J. Nigo, Y. Takahashi, A. Ogane, Y. Nishihara, Y. Uraoka, and T. Fuyuki, "Effective Interface Modification by  $\text{NH}_3$  Plasma for Silicon Surface Passivation at Very Low Temperatures," 21st European Photovoltaic Solar Energy Conference, pp. 934-937, Sep 2006.

S. Olibet, E. Vallat-Sauvain, and C. Ballif, "Effect of Light Induced Degradation on Passivating Properties of a-Si:H Layers Deposited on Crystalline Si," 21st European Photovoltaic Solar Energy Conference, pp. 1366-1369, Sep 2006.

P. Papet, O. Nichiporuk, S. Amtblan, J. Kraiem, J-F. Lelievre, J. Gregoire, A. Kaminski, A. Fave, and M. Lemiti, "Realization of Self-Aligned Back-Contact Solar Cells.," 21st European Photovoltaic Solar Energy Conference, pp. 758-761, Sep 2006.

R. Petres, J. Libal, T. Buck, R. Kopecek, M. Vetter, R. Ferre, I. Martín, D. Borchert, and P. Fath, "Improvements in the Passivation of P+-Si Surfaces by PECVD Silicon Carbide Films," 4th World Conference on Photovoltaic Energy Conversion, pp. 1012-1015, May 2006.

S. Ponce-Alcántara, C. del Cañizo, and A. Luque, "Integration of Silicon Nitride Layers in Multicrystalline Silicon Solar Cell Processes," 21st European Photovoltaic Solar Energy Conference, pp. 1150-1153, Sep 2006.

F. Recart, H. Mäckel, A. Cuevas, and R.A. Sinton, "Simple Data Acquisition of the Current-Voltage and Illumination-voltage Curves of Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 1215-1218, May 2006.

J. Rentsch, O. Schultz, A. Grohe, D. Biro, R. Preu, and G. P. Willeke, "Technology Route Towards Industrial Application of Rear Passivated Silicon Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 1008-1011, May 2006.

C.E. Richardson, Y. Park, and H.A. Atwater, "Surface Evolution During Low Temperature Epitaxial Silicon Growth by Hot-Wire Chemical Vapor Deposition: Structural and Electronic Properties," 4th World Conference on Photovoltaic Energy Conversion, pp. 1672-1675, May 2006.

I.G. Romijn, M. Koppes, E.J. Kossen, C.J.J. Tool, and A.W. Weeber, "High Efficiencies on Mc-Si Solar Cells Enabled by Industrial Firing Through Rear Side Passivating SiNx:H," 21st European Photovoltaic Solar Energy Conference, pp. 705-708, Sep 2006.

T. Roth, M. Rüdiger, S. Diez, T. Trupke, R.A. Bardos, and S.W. Glunz, "Temperature- and Injection-Dependent Photoluminescence Lifetime Spectroscopy," 21st European Photovoltaic Solar Energy Conference, pp. 593-596, Sep 2006.

J. Salami, B. Cruz, and A. Shaikh, "Diffusion Paste Development for Printable IBC and Bifacial Silicon Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 1323-1326, May 2006.

C. Schmiga, H. Nagel, R. Bock, J. Schmidt, and R. Brendel, "Advances in the Manufacturing of N-Type Silicon Solar Cells with Screen-Printed Aluminium-Alloyed Rear Emitter," 21st European Photovoltaic Solar Energy Conference, pp. 617-620, Sep 2006.

O. Schultz, S.W. Glunz, S. Riepe, and G.P. Willeke, "Gettering of Multicrystalline Silicon for High-Efficiency Solar Cells," 21st European Photovoltaic Solar Energy Conference, pp. 788-791, Sep 2006.

O. Schultz, J. Rentsch, A. Grohe, S.W. Glunz, and G.P. Willeke, "Dielectric Rear Surface Passivation for Industrial Multicrystalline Silicon Solar Cells," 4th World Conference on Photovoltaic Energy Conversion, pp. 885-888, May 2006.

R.A. Sinton, "A Solution To the Problem of Accurate Flash-Testing of High-Efficiency Modules," 21st European Photovoltaic Solar Energy Conference, pp. 634-637, Sep 2006.

D. Song, T.M. Walsh, and A.G. Aberle, "Monolithically Integrated Polycrystalline Silicon Thin-Film Mini-Modules on Glass," 4th World Conference on Photovoltaic Energy Conversion, pp. 2094-2097, May 2006.

J. Tan, A. Cuevas, D. Macdonald, K. Roth, D.H. Neuhaus, and M. hosh, "Investigation of Industrial Processing and Its Impacts on Multi-Crystalline Silicon Substrate Quality," 21st European Photovoltaic Solar Energy Conference, pp. 881-884, Sep 2006.

M.L. Terry, D. Inns, and A.G. Aberle, "Massive Improvement Through Rapid Thermal Annealing and Hydrogen Passivation of Poly-Si Thin-Film Solar Cells on Glass Based on Aluminum Induced Crystallization," 4th World Conference on Photovoltaic Energy Conversion, pp. 1560-1563, May 2006.

M. Tucci, L. Serenelli, S. De Iuliis, E. Salza, and L. Pirozzi, "Dry Nf3/O2 Plasma

Texturing of Multi-Crystalline Silicon," 21st European Photovoltaic Solar Energy Conference, pp. 1250-1253, Sep 2006.

F. Tyholdt, A. Ulyashin, M. Mottern, A.T.J. van Helvoort, and H. Raeder, "ITO Films for Solar Cells Made by Chemical Solution Deposition," 21st European Photovoltaic Solar Energy Conference, pp. 311-314, Sep 2006.

A. Ulyashin, B. Eidelman, G. Untila, A. Chebotareva, T. Kost, A. Suphellen, A. Bentzen, A. Holt, and E. Sauar, "Passivation of Silicon Surface by Transparent Conductive Oxide Containing Layers," 21st European Photovoltaic Solar Energy Conference, pp. 1235-1238, Sep 2006.

A.G. Ulyashin, A. Bentzen, S. Diplas, A. Suphellen, A.E. Gunnaes, A. Olsen, B.G. Svensson, E.S. Marstein, A. Holt, D. Grambole, and E. Sauar, "Hydrogen Release and Defect Formation During Heat Treatments of SiNx:H/a-Si:H Double Passivation Layer on C-Si Substrate," 4th World Conference on Photovoltaic Energy Conversion, pp. 1354-1357, May 2006.

G. Untila, T. Kost, A. Chebotareva, B. Eydelman, and A. Yaremchuk, "Comparison of (N+Pp+)Cz-Si Solar Cells with Arc of Ito Deposited by Magnetron Sputtering and Ifo Deposited by Spray Pyrolysis.," 21st European Photovoltaic Solar Energy Conference, pp. 1261-1264, Sep 2006.

G. Untila, T. Kost, A. Chebotareva, M. Zaks, A. Sitnikov, and O. Solodukha, "Indium Oxide Based Tco/Silicon: Junction Properties.," 21st European Photovoltaic Solar Energy Conference, pp. 1199-1202, Sep 2006.

A.J.M. van Erven, R.C.M. Bosch, W.T.M. Stals, C.H. Kant, R. Backer, and M.D. Bijker, "Characterization of Stress in High-Rate ETP Deposited Silicon Nitride Before and After Annealing," 21st European Photovoltaic Solar Energy Conference, pp. 1371-1374, Sep 2006.

M. Vetter, R. Ferre, I. Martín, P. Ortega, R. Alcubilla R. Petres, J. Libal, and R. Kopecek, "Investigation of the Surface Passivation of P+-Type Si Emitters by PECVD Silicon Carbide Films," 4th World Conference on Photovoltaic Energy Conversion, pp. 1271-1274, May 2006.

T. Weber, C. Zechner, D. Macdonald, and P.P. Altermatt, "Numerical Simulation of Gettering and Recombination in Iron-Contaminated Boron Emitters," 21st European Photovoltaic Solar Energy Conference, pp. 1486-1489, Sep 2006.

K. Wilson, D. De Ceuster, and R.A. Sinton, "Measuring the Effect of Cell Mismatch on Module Output," 4th World Conference on Photovoltaic Energy Conversion, pp. 916-919, May 2006.

D. N. Wright, E.V. Monakhov, E.S. Marstein, A.Yu. Kuznetsov, B.G. Svensson, and A. Holt, "The Effect on Surface Passivation of the Deposition Power in Plasma Enhanced Chemical Vapour Deposited Silicon Nitride," 21st European Photovoltaic Solar Energy Conference, pp. 842-845, Sep 2006.

B. Zouma, I. Lyo, A. Diao, F. Zougmore, and G. Issoko, "Three-Dimensional Approach



of Spectral Response for Polycrystalline Silicon Solar Cell Under a Constant Magnetic Field," 21st European Photovoltaic Solar Energy Conference, pp. 451-454, Sep 2006.

## 2005

A.G. Aberle, A. Straub, P.I. Widenborg, A.B. Sproul, Y. Huang, and P. Campbell, "Polycrystalline silicon thin-film solar cells on glass by aluminium-induced crystallisation and subsequent ion-assisted deposition (ALICIA)," *Progress in Photovoltaics*, vol. 13, no. 1, pp. 37-47, Jan. 2005.

G. Andrä, J. Bergmann, A. Bochmann, F. Falk, E. Ose, S. Dauwe, and T. Kieliba, "Characterization and Simulation of Multicrystalline LLC-Si Thin Film Solar Cells," *20th European Photovoltaic Energy Conference*, Jun 2005.

N. Arifuku, M. Dhamrin, T. Inoshita, M. Suda, T. Saitoh, and K. Kamisako, "Effect of Thermal Annealing on Recombination Lifetime of mc-Si Wafers Passivated with SiN<sub>x</sub>:H Films," *20th European Photovoltaic Energy Conference*, Jun 2005.

N. Arifuku, M. Dhamrin, M. Suda, T. Saitoh, K. Kamisako, T. Hirasawa, T. Eguchi, and I. Yamaga, "Passivation Effect of SiN<sub>x</sub>:H films on Ga-doped Crystalline Silicon Wafers," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.

D. Baek, S. Rouvimov, B. Kim, T.C. Jo, and D.K. Schroder, "Surface recombination velocity of silicon wafers by photoluminescence," *Applied Physics Letters*, vol. 86, no. 11, Mar 2005.

R.A. Bardos, and T. Trupke, "Self-Consistent Determination of the Generation Rate in Photoluminescence and Photoconductance Lifetime Measurements," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 899-902, Jan 2005.

P.A. Basore, "Crystalline Silicon on Glass Device Optimization," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 967-970, Jan 2005.

D. L. Bätzner, J. Tan, K. Hanton, R. Ferre, D. Macdonald, A. Cuevas, S. Peters, D. H. Neuhaus, and M. Ghosh, "Dependence of Phosphorous Gettering of Multicrystalline Silicon on Diffusion Sheet Resistance and Ingot Position," *20th European Photovoltaic Energy Conference*, Jun 2005.

A. Bentzen, H. Tathgar, J. Barthez, and A. Holt, "High Trap Densities in Wafers from Regions of Reduced Lifetime in Multicrystalline Silicon Blocks," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.

A. Bentzen, H. Tathgar, R. Kopecek, R. Sinton, and A. Holt, "Recombination Lifetime and Trap Density Variations in Multicrystalline Silicon Wafers Through the Block," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 1074-1077, Jan 2005.

A. Bentzen, A. Ulyashin, A. Suphellen, E. Sauar, D. Grambole, D.N. Wright, E.S. Marstein, B.G. Svensson, and A. Holt, "Surface Passivation of Silicon Solar Cells by Amorphous Silicon/Silicon Nitride Dual Layers," *15th International Photovoltaic*

*Science & Engineering Conference*, Oct 2005.

J.E. Birkholz, K. Bothe, D. Macdonald, and J. Schmidt, "Recombination Parameters of Iron-Boron Pairs in Boron-Doped Crystalline Silicon," *20th European Photovoltaic Energy Conference*, Jun 2005.

J.E. Birkholz, K. Bothe, D. Macdonald, and J. Schmidt, "Electronic properties of iron-boron pairs in crystalline silicon by temperature- and injection-level-dependent lifetime measurements," *Journal of Applied Physics*, vol. 97, no. 10, May 2005.

E. Bobeico, G. Flaminio, G. Gerla, L. Lancellotti, N. Martucciello, P. Morvillo, F. Roca, and C. Vernetti, "Technology for the Production of 20% Efficiency C-Si Solar Cells for Concentrating Systems," *20th European Photovoltaic Energy Conference*, Jun 2005.

K. Bothe, and J. Schmidt, "Rapid Initial Degradation of Cz Silicon Solar Cells," *20th European Photovoltaic Energy Conference*, Jun 2005.

K. Bothe, and J. Schmidt, "Fast-forming boron-oxygen-related recombination center in crystalline silicon," *Applied Physics Letters*, vol. 87, no. 26, Dec 2005.

K. Bothe, R. Sinton, and J. Schmidt, "Fundamental boron-oxygen-related carrier lifetime limit in mono- and multicrystalline silicon," *Progress in Photovoltaics*, vol. 13, no. 4, pp. 287-296, Jun. 2005.

W. Brendle, V. Nguyen, K. Brenner, P. J. Rostan, A. Grohe, E. Schneiderlöchner, R. Preu, U. Rau, G. Palfinger, and J. H. Werner, "Low Temperature Back Contact for High Efficiency Silicon Solar Cells," *20th European Photovoltaic Energy Conference*, Jun 2005.

K.E. Brown, R.L. Mitchell, W.I. Bower, and R. King, "PV Manufacturing R&D Project Status & Accomplishments Under "In-Line Diagnostics & Intelligent Processing"," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 1671-1674, Jan 2005.

T. Buonassisi, A.A. Heuer, M. Istratov, M.A. Marcus, R. Jonczyk, J. Isenberg, B. Lai, Z.H. Cai, S. Heald, W. Warta, R. Schindler, G. Willeke, and E.R. Weber, "Synchrotron-based investigations of the nature and impact of iron contamination in multicrystalline silicon solar cells," *Journal of Applied Physics*, vol. 97, no. 7, Apr 2005.

L.J. Caballero, C. del Canizo, P. Sanchez-Friera, and A. Luque, "Influence of P gettering thermal step on light-induced degradation in Cz Si," *Solar Energy Materials and Solar Cells*, vol. 88, no. 3, pp. 247-256, Aug 2005.

L. Carnel, I. Gordon, K. Van Nieuwenhuysen, D. Van Gestel, G. Beaucarne, and J. Poortmans, "Defect passivation in chemical vapour deposited fine-grained polycrystalline silicon by plasma hydrogenation," *Thin Solid Films*, vol. 487, no. 38719, pp. 147-151, Sep 2005.

M.S. Carroll, and C.A. King, "Shortened photoconductance lifetime of Si/SiGe hetero structures due to interfacial oxygen or carbon from incomplete in-situ hydrogen cleans," *Thin Solid Films*, vol. 473, no. 1, pp. 137-144, Feb 2005.

R. Chen, K. Fisher, H. Li, J. Ji, Y. Wang, and Z. Shi, "Using PCD Method to Optimize Standard BCSC Processes," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.

J. Coello, C. del Cañizo, and A. Luque, "Parameter Distribution in Multicrystalline Silicon Ingots," *20th European Photovoltaic Energy Conference*, Jun 2005.

P. J. Cousins, N. B. Mason, and J. E. Cotter, "Manufacturing and Design Issues for Thin Silicon Solar Cells Manufactured on FZ(B), MCz(B), Cz(Ga) and Cz(B) Wafers.," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 987-990, Jan 2005.

P.J. Cousins, M.D. Abbott, and J.E. Cotter, "Impact of Furnace Transients on the Lifetime of Upright Randomly Textured Wafers Evaluated Using Photoconductance Lifetime Measurements," *20th European Photovoltaic Energy Conference*, Jun 2005.

A. Cuevas, and F. Recart, "Capacitive effects in quasi-steady-state voltage and lifetime measurements of silicon devices," *Journal of Applied Physics*, vol. 98, no. 7, Oct 2005.

S. De Wolf, G. Agostinelli, G. Beaucarne, and P. Vitanov, "Influence of stoichiometry of direct plasma-enhanced chemical vapor deposited SiNx films and silicon substrate surface roughness on surface passivation," *Journal of Applied Physics*, vol. 97, no. 6, Mar 2005.

P.N.K. Deenapanray, C.S. Athukorala, D. Macdonald, V.E. Everett, K.J. Weber, and A.W. Blakers, "Influence of Reactive Ion Etching on the Minority Carrier Lifetime in P-Type Si," *20th European Photovoltaic Energy Conference*, Jun 2005.

P.N.K. Deenapanray, M. Horteis, D. Macdonald, and K.J. Weber, "Minority carrier lifetime properties of reactive ion etched p-type float zone Si," *Electrochemical and Solid State Letters*, vol. 8, no. 3, pp. G78-G81, 2005.

M. Dhamrin, K. Kamisako, and T. Saitoh, "Effect of Fe-Ga Pairs Dissociation and Association Processes on Recombination Lifetimes in Multicrystalline Si Solar Cells," *20th European Photovoltaic Energy Conference*, Jun 2005.

M. Dhamrin, K. Kamisako, T. Saitoh, T. Eguchi, T. Hirasawa, and I. Yamaga, "Technical Progress of High-Quality, Ga-Doped Multicrystalline Silicon Wafers and Solar Cells," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 915-918, Jan 2005.

M. Dhamrin, K. Kamisako, T. Saitoh, T. Eguchi, T. Hirasawa, and I. Yamaga, "Effect of low segregation coefficient on Ga-doped multicrystalline silicon solar cell performance," *Progress in Photovoltaics*, vol. 13, no. 7, pp. 597-606, Nov. 2005.

S. Diez, S. Rein, and S.W. Glunz, "Analysing Defects in Silicon by Temperature- and Injectiondependent Lifetime Spectroscopy (T-IDLS)," *20th European Photovoltaic Energy Conference*, Jun 2005.

T. Eguchi, T. Hirasawa, I. Yamaga, M. Dhamrin, T. Saitoh, and K. Kamisako, "Effect of Directional Solidification Processes on Diffusion Length Distribution of High Quality

Multicrystalline Silicon Ingots," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.

U.A. Elani, M.S. Al-Salhi, S.A. Kamh, and J.M. Al-Otaibi, "The conductivity modulation of silicon samples under dark and gamma irradiation conditions," *Solar Energy*, vol. 78, no. 1, pp. 23-29, 2005.

N. Enjalbert, F. Oustier, N. Lê Quang, and R. Sinton, "Automated In-Line Control of Electrical Parameters on Large Dimension mc-Si Wafers on Industrial Scale," *20th European Photovoltaic Energy Conference*, Jun 2005.

N. Enjalbert, and R.A. Sinton, "Quasi-Steady-State Lifetime Measurements on Blocks : Prediction of Cell Efficiency," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 911-914, Jan 2005.

M. Garin, U. Rau, W. Brendle, I. Martin, and R. Alcubilla, "Characterization of a-Si : H/c-Si interfaces by effective-lifetime measurements," *Journal of Applied Physics*, vol. 98, no. 9, Nov 2005.

J. C. Goldschmidt, O. Schultz, and S. W. Glunz, "Predicting Multi-Crystalline Silicon Solar Cell Parameters from Carrier Density Images," *20th European Photovoltaic Energy Conference*, Jun 2005.

J. Guo, B.S. Tjahjono, and J.E. Cotter, "19.2% Efficiency N-Type Laser-Grooved Silicon Solar Cells," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 983-986, Jan 2005.

R. Gutiérrez, I. Freire, F. Recart, L. Pérez, K. Varner, M.A. Vázquez, and J. Alonso, "Optimization of Screen Printed Emitters in a Fully Automatic Industrial In-Line Solar Cell Production," *20th European Photovoltaic Energy Conference*, Jun 2005.

P. Hacke, and J.M. Gee, "A screen-printed interdigitated back contact cell using a boron-source diffusion barrier," *Solar Energy Materials and Solar Cells*, vol. 88, no. 1, pp. 119-127, Jun 2005.

J. Henze, P. Pohl, C. Schmiga, M. Dhamrin, T. Saitoh, I. Yamaga, and J. Schmidt, "Millisecond Area-Averaged Lifetimes in Gallium-Doped Multicrystalline Silicon," *20th European Photovoltaic Energy Conference*, Jun 2005.

M.M. Hilali, M.M. Al Jassim, B. To, H. Moutinho, A. Rohatgi, and S. Asher, "Understanding the formation and temperature dependence of thick-film Ag contacts on high-sheet-resistance Si emitters for solar cells," *Journal of the Electrochemical Society*, vol. 152, no. 10, pp. G742-G749, 2005.

B. Hoex, A.J.M. van Erven, M.D. Bijker, P.J. van den Oever, W.M.M. Kessels, and M.C.M. van de Sanden, "Industrial High-Rate ( $\approx 4$  nm/s) Deposited Silicon Nitride with Low Surface Recombination Velocities Under Optimum Antireflection Coating Conditions," *20th European Photovoltaic Energy Conference*, Jun 2005.

B. Hoex, A.J.M. van Erven, R.C.M. Bosch, W.T.M. Stals, M.D. Bijker, P.J. van den Oever, W.M.M. Kessels, and M.C.M. van de Sanden, "Industrial high-rate (similar to 5

nm/s) deposited silicon nitride yielding high-quality bulk and surface passivation under optimum anti-reflection coating conditions," *Progress in Photovoltaics*, vol. 13, no. 8, pp. 705-712, Dec. 2005.

J. Hoonstra, G. Schubert, K. Broek, F. Granek, and C. LePrince, "Lead Free Metallisation Paste for Crystalline Silicon Solar Cells: from Model To Results," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 1293-1296, Jan 2005.

L. Janßen, M. Rinio, H. Windgassen, W.A. Nositschka, D. Borchert, and H. Kurz, "Double Sided Silicon Nitride Passivated Thin Screen Printed Multicrystalline Silicon Solar Cells," *20th European Photovoltaic Energy Conference*, Jun 2005.

M.S. Jeon, M. Dhamrin, T. Saitoh, and K. Kamisako, "Improvement of N+ Diffusion Process in Simplified Screen-Printed Method for Crystalline Solar Cells," *20th European Photovoltaic Energy Conference*, Jun 2005.

M.J. Keevers, A. Turner, U. Schubert, P.A. Basore, and M.A. Green, "Remarkably Effective Hydrogenation of Crystalline Silicon on Glass Modules," *20th European Photovoltaic Energy Conference*, Jun 2005.

W.M.M. Kessels, P.J. van den Oever, B. Hoex, R.C.M. Bosch, A.J.M. van Erven, M.D. Bijker, and M.C.M. van de Sanden, "Controlling the Silicon Nitride Film Density for Ultrahigh-Rate Deposition of Top Quality Antireflection Coatings," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 1253-1256, Jan 2005.

V.K. Khanna, "Physical understanding and technological control of carrier lifetimes in semiconductor materials and devices: A critique of conceptual development, state of the art and applications," *Progress in Quantum Electronics*, vol. 29, no. 2, pp. 59-163, 2005.

R. Kopecek, J. Libal, T. Buck, K. Peter, K. Wambach, M. Acciarri, S. Binetti, L. J. Geerligs, and P. Fath, "N-Type Multicrystalline Silicon: Material for Solar Cell Processes with High Efficiency Potential," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 1257-1260, Jan 2005.

G. Kumaravelu, M.M. Alkaisi, D. Macdonald, J. Zhao, B. Rong, and A. Bittar, "Minority carrier lifetime in plasma-textured silicon wafers for solar cells," *Solar Energy Materials and Solar Cells*, vol. 87, no. 1-4, pp. 99-106, May 2005.

O. Kunz, R. Brüggemann, A. Straub, A.B. Sproul, and A.G. Aberle, "Determination of the Two-Diode Model Parameters of Non-Ideal Solar Cells," *20th European Photovoltaic Energy Conference*, Jun 2005.

R. Lago-Aurrekoetxea, C. del Canizo, I. Tobias, and A. Luque, "Measurement of bulk and rear recombination components and application to solar cells with an Al back layer," *Solid-State Electronics*, vol. 49, no. 1, pp. 49-55, Jan. 2005.

J-F. Lelièvre, Y. Rozier, A. Bernaudeau, O. Palais, A.aminski, S. Quoizola, O. Nichiporuk, M. Bérenguer, P. Girard, J-C. Loretz, C. Giral, Y. Pellegrin, and M. Lemiti, "Surface and Bulk Passivation of Silicon by LFPECVD Hydrogenated Silicon Nitride SiNx:H," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.

- J.M. Li, M. Chong, L.Q. Yang, J.D. Xu, X.F. Duan, M. Gao, F.L. Wang, H.T. Liu, L. Bian, X. Chi, and Y.H. Zhai, "A new technique for boosting efficiency of silicon solar cells," *Solar Energy Materials and Solar Cells*, vol. 86, no. 4, pp. 585-591, Apr 2005.
- J. Libal, R. Petres, R. Kopecek, G. Hahn, K. Wambach, and P. Fath, "N-Type Multicrystalline Silicon Solar Cells with BBr<sub>3</sub>-Diffused Front Junction," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 1209-1212, Jan 2005.
- Z. Liu, T. Chen, H. Liao, J. Li, and J.L.X. Ma, "Minority Carrier Lifetime of Silicon Solar Cells Research and Measurement," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.
- J. Lossen, L. Mittelstädt, S. Dauwe, K. Lauer, and C. Beneking, "Making Use of Silicon Wafers with Low Lifetimes by Adequate POCl<sub>3</sub> Diffusion," *20th European Photovoltaic Energy Conference*, Jun 2005.
- D. MacDonald, "Impact of nickel contamination on carrier recombination in n- and p-type crystalline silicon wafers," *Applied Physics A-Materials Science & Processing*, vol. 81, no. 8, pp. 1619-1625, Dec. 2005.
- D. Macdonald, A. Cuevas, A. Kinomura, Y. Nakano, and L.J. Geerligs, "Transition-metal profiles in a multicrystalline silicon ingot," *Journal of Applied Physics*, vol. 97, no. 3, Feb 2005.
- D. Macdonald, A. Cuevas, K. McIntosh, L. Barbosa, and D.D. Ceuster, "Impact of Cr, Fe, Ni, Ti and W Surface Contamination on Diffused and Oxidised N-Type Crystalline Silicon Wafers," *20th European Photovoltaic Energy Conference*, Jun 2005.
- D. Macdonald, P.N.K. Deenapanray, A. Cuevas, S. Diez, and S.W. Glunz, "The role of silicon interstitials in the formation of boron-oxygen defects in crystalline silicon," *Gettering and Defect Engineering in Semiconductor Technology Xi, SOLID STATE PHENOMENA*, (2005).
- D. Macdonald, T. Roth, P.N.K. Deenapanray, K. Bothe, P. Pohl, and J. Schmidt, "Formation rates of iron-acceptor pairs in crystalline silicon," *Journal of Applied Physics*, vol. 98, no. 8, Oct 2005.
- D. Macdonald, T. Roth, L.J. Geerligs, and A. Cuevas, "Behaviour of natural and implanted iron during annealing of multicrystalline silicon wafers," *Gettering and Defect Engineering in Semiconductor Technology Xi, SOLID STATE PHENOMENA*, (2005).
- H. Mackel, and A. Cuevas, "Open-circuit voltage quantum efficiency technique for defect spectroscopy in semiconductors," *Applied Physics Letters*, vol. 87, no. 10, Sep 2005.
- G.D.K. Mahanama, and H.S. Reehal, "Dark and illuminated characteristics of crystalline silicon solar cells with ECR plasma CVD deposited emitters," *International Journal of Electronics*, vol. 92, no. 9, pp. 525-537, Sep. 2005.
- M. McCann, K. Weber, and A. Blakers, "Surface passivation by rehydrogenation of silicon-nitride-coated silicon wafers," *Progress in Photovoltaics*, vol. 13, no. 3, pp. 195-

200, May 2005.

T. Nagashima, K. Hokoi, K. Okumura, and M. Yamaguchi, "Efficiency Improvements of Back-Contact Type Photovoltaic by a Floating Emitter," *20th European Photovoltaic Energy Conference*, Jun 2005.

K. Nakayashiki, V. Meemongkolkiat, and A. Rohatgi, "Effect of material inhomogeneity on the open-circuit voltage of string ribbon Si solar cells," *IEEE Transactions on Electron Devices*, vol. 52, no. 10, pp. 2243-2249, Oct. 2005.

O. Nichiporuk, A. Kaminski, M. Lemiti, A. Fave, J. Kraiem, . Litvinenko, and V. Skryshevsky, "Self-Aligned Back-Contacts Solar Cells," *20th European Photovoltaic Energy Conference*, Jun 2005.

O. Nichiporuk, A. Kaminski, M. Lemiti, A. Fave, and V. Skryshevsky, "Optimisation of interdigitated back contacts solar cells by two-dimensional numerical simulation," *Solar Energy Materials and Solar Cells*, vol. 86, no. 4, pp. 517-526, Apr 2005.

E. Olsen, H. Nordmark, and E. Øvrelid, "Studies of Selected Silicon Feedstock Impurities Effect on Properties of Multicrystalline Silicon Ingots," *20th European Photovoltaic Energy Conference*, Jun 2005.

A. Orpella, M. Vetter, R. Ferre, I. Martin, J. Puigdollers, C. Voz, and R. Alcubilla, "Phosphorus-diffused silicon solar cell emitters with plasma enhanced chemical vapor deposited silicon carbide," *Solar Energy Materials and Solar Cells*, vol. 87, no. 1-4, pp. 667-674, May 2005.

P. Ortega, M. Vetter, S. Bermejo, I. Torres, and R. Alcubilla, "Injection-Dependent Lifetime Spectroscopy and Pc-1D Simulations of Phosphorus Emitters Doped with Solid Diffusion Sources," *20th European Photovoltaic Energy Conference*, Jun 2005.

G. Pellegrini, J.M. Rafi, M. Ullan, M. Lozano, C. Fleta, and F. Campabadal, "Characterization of magnetic Czochralski silicon radiation detectors," *Nuclear Instruments & Methods in Physics Research Section A-Accelerators Spectrometers Detectors and Associated Equipment*, vol. 548, no. 3, pp. 355-363, Aug 2005.

R. Petres, J. Libal, R. Kopecek, M. Vetter, R. Ferre, I. Martín, D. Borchert, I. Röver, K. Wambach, and P. Fath, "Passivation of p+-Surfaces by PECVD Silicon Carbide Films - A Promising Method for Industrial Silicon Solar Cell Applications," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.

P. Pohl, J. Schmidt, K. Bothe, and R. Brendel, "Mapping of trap densities and energy levels in semiconductors using a lock-in infrared camera technique," *Applied Physics Letters*, vol. 87, no. 14, Oct 2005.

S. Ponce-Alcantara, C. Del Canizo, and A. Luque, "Adaptation of monocrystalline solar cell process to multicrystalline materials," *Solar Energy Materials and Solar Cells*, vol. 87, no. 1-4, pp. 411-421, May 2005.

S. Qu, Z. Liu, T. Chen, H. Liao, X. Ma, and Z. Du, "Fabrication of Selective Emitter Solar Cells," *15th International Photovoltaic Science & Engineering Conference*, Oct

2005.

F. Recart, G. Bueno, V. Rodríguez, I. Freire, and L. Pérez & R. Lago-Aurrekoetxea, "Large Area Thin BSF Solar Cells with Simultaneously Diffused Boron and Phosphorus Screen Printed Emitters," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 1213-1216, Jan 2005.

F. Recart, and A. Cuevas, "Impact of Junction Capacitance on Quasi-Steady-State Voltage Measurements of Silicon Solar Cells," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.

S. Rein, and S.W. Glunz, "Electronic properties of interstitial iron and iron-boron pairs determined by means of advanced lifetime spectroscopy," *Journal of Applied Physics*, vol. 98, no. 11, Dec 2005.

J. Rentsch, F. Bamberg, E. Schneiderlöchner, and R. Preu, "Texturing of Multicrystalline Silicon by Laser Ablation," *20th European Photovoltaic Energy Conference*, Jun 2005.

J. Rentsch, C. chetter, H. Schlemm, K. Roth, and R. Preu, "Industrialisation of Dry Phosphorus Silicate Glass Etching and Edge Isolation for Crystalline Silicon Solar Cells," *20th European Photovoltaic Energy Conference*, Jun 2005.

J. Rentsch, N. Kohn, F. Bamberg, K. Roth, S. Peters, R. Lüdemann, and R. Preu, "Isotropic Plasma Texturing of Mc-Si for Industrial Solar Cell Fabrication," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 13161319, Jan 2005.

S. Riepe, M. Ghosh, A. Müller, H. Lautenschlager, R. Schindler, and W. Warta, "Lifetime Characteristics and Gettering Effects in N-Type Multicrystalline Silicon Block Material," *20th European Photovoltaic Energy Conference*, Jun 2005.

D. Rose, and S. Daroczi, "Development and Manufacture of Reliable PV Modules with >17% Efficiency," *20th European Photovoltaic Energy Conference*, Jun 2005.

A. Royne, C.J. Dey, and D.R. Mills, "Cooling of photovoltaic cells under concentrated illumination: a critical review," *Solar Energy Materials and Solar Cells*, vol. 86, no. 4, pp. 451-483, Apr 2005.


M. Schaper, J. Schmidt, H. Plagwitz, and R. Brendel, "20.1%-Efficient crystalline silicon solar cell with amorphous silicon rear-surface passivation," *Progress in Photovoltaics*, vol. 13, no. 5, pp. 381-386, Aug. 2005.

J. Schmidt, and D. Macdonald, "Recombination activity of iron-gallium and iron-indium pairs in silicon," *Journal of Applied Physics*, vol. 97, no. 11, Jun 2005.

M.C. Schubert, J. Isenberg, S. Rein, S. Bermejo, S.W. Glunz, and W. Warta, "Injection Dependent Carrier Density Imaging Measurements Including Correction for Trapping Effects," *20th European Photovoltaic Energy Conference*, Jun 2005.

O. Schultz, S.W. Glunz, D. Kray, M. Dhamrin, I. Yamaga, T. Saitoh, and G.P. Willeke, "High-Efficiency Multicrystalline Silicon Solar Cells on Gallium-Doped Substrate," *20th European Photovoltaic Energy Conference*, Jun 2005.



R.A. Sinton, D. De Ceuster, K. Wilson, and L.R. Barbosa, "Flash Testing High-Efficiency Silicon Solar Cells and Modules," *20th European Photovoltaic Energy Conference*, Jun 2005. 

Discusses the device physics of flash-test measurement of high-efficiency cells and modules. An accurate flash-test methodology for high-efficiency silicon cells is demonstrated.

A. Slade, and V. Garboushian, "27.6% Efficient Silicon Concentrator Solar Cells for Mass Production," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.

A. Slade, S. Yoon, and V. Garboushian, "High Efficiency Solar Cells for Concentrator Systems: Silicon or Multi-Junction ?," *20th European Photovoltaic Energy Conference*, Jun 2005.

C.S. Solanki, L. Carnel, K. Van Nieuwenhuysen, A. Ulyashin, N. Posthuma, G. Beaucarne, and J. Poortmans, "Thin-film free-standing monocrystalline Si solar cells with heterojunction emitter," *Progress in Photovoltaics*, vol. 13, no. 3, pp. 201-208, May 2005.

W. Soppe, H. Rieffe, and A. Weeber, "Bulk and surface passivation of silicon solar cells accomplished by silicon nitride deposited on industrial scale by microwave PECVD," *Progress in Photovoltaics*, vol. 13, no. 7, pp. 551-569, Nov. 2005.

S. Stepanov, and S. Ruschin, "Phase and amplitude modulation of light by light in silicon-on-insulator waveguides," *Electronics Letters*, vol. 41, no. 8, pp. 477-478, Apr 2005.

A. Straub, D. Inns, M.L. Terry, R. Gebbs, and A.G. Aberle, "The influence of defects and postdeposition treatments on the free carrier density in lightly phosphorus-doped large-grained polycrystalline silicon films," *Journal of Applied Physics*, vol. 98, no. 2, Jul 2005.

A. Straub, D. Inns, M.L. Terry, Y. Huang, P.I. Widenborg, and A.G. Aberle, "Optimisation of low-temperature silicon epitaxy on seeded glass substrates by ion-assisted deposition," *Journal of Crystal Growth*, vol. 280, no. 38780, pp. 385-400, Jul 2005.

J. Tan, A. Cuevas, S. Winderbaum, and K. Roth, "Thermal Stability of the Passivation of Phosphorus Diffused Silicon Surfaces by PECVD Silicon Nitride," *20th European Photovoltaic Energy Conference*, Jun 2005.

M.L. Terry, A. Straub, D. Inns, D. Song, and A.G. Aberle, "Voc Improvement of Evaporated SPC Thin-Film Si Solar Cells on Glass by Rapid Thermal Annealing," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 971-974, Jan 2005.

M.L. Terry, A. Straub, D. Inns, D.Y. Song, and A.G. Aberle, "Large open-circuit voltage improvement by rapid thermal annealing of evaporated solid-phase-crystallized thin-film silicon solar cells on glass," *Applied Physics Letters*, vol. 86, no. 17, Apr 2005.

M. Tivanov, A. Patryn, N. Drozdov, A. Fedotov, and A. Mazanik, "Determination of solar cell parameters from its current-voltage and spectral characteristics," *Solar Energy Materials and Solar Cells*, vol. 87, no. 1-4, pp. 457-465, May 2005.

C.J.J. Tool, G. Coletti, F.J. Granek, J. Hoornstra, M. Koppes, E.J. Kossen, H.C. Rieffe, I.G. Romijn, and A.W. Weeber, "17% Mc-Si Solar Cell Efficiency Using Full In-Line Processing with Improved Texturing and Screen-Printed Contacts on High-Ohmic Emitters," *20th European Photovoltaic Energy Conference*, Jun 2005.

T. Trupke, and R.A. Bardos, "Photoluminescence: a Surprisingly Sensitive Lifetime Technique," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 903-906, Jan 2005.

T. Trupke, R.A. Bardos, and M.D. Abbott, "Self-consistent calibration of photoluminescence and photoconductance lifetime measurements," *Applied Physics Letters*, vol. 87, no. 18, Oct 2005.

T. Trupke, R.A. Bardos, M.D. Abbott, and J.E. Cotter, "Suns-photoluminescence: Contactless determination of current-voltage characteristics of silicon wafers," *Applied Physics Letters*, vol. 87, no. 9, Aug 2005.

A. Upadhyaya, M. Sheoran, and A. Rohatgi, "Study of Direct PECVD SiN<sub>x</sub>-Induced Surface Emitter and Bulk Defect Passivation in P-Type Silicon Solar Cells," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 1273-1276, Jan 2005.

A. Upadhyaya, M. Sheoran, and A. Rohatgi, "High-efficiency screen-printed belt co-fired solar cells on cast multicrystalline silicon," *Applied Physics Letters*, vol. 86, no. 5, Jan 2005.

A.S.H. van der Heide, A. Schonecker, J.H. Bultman, and W.C. Sinke, "Explanation of high solar cell diode factors by nonuniform contact resistance," *Progress in Photovoltaics*, vol. 13, no. 1, pp. 3-16, Jan. 2005.

K. Varner, R. Gutiérrez, V. Rodríguez, J.C. Jimeno, and C. Ikarán, "Towards Optimization of the TWT," *20th European Photovoltaic Energy Conference*, Jun 2005.

M. Vetter, S. Bermejo, I. Martín, M. Garin, R. Alcubilla, S. Riepe, S. Rein, and W. Warta, "Comparison of the Surface Passivation Quality of SiC<sub>x</sub> and SiN<sub>x</sub> Films on p-Type and n-Type Multicrystalline Silicon," *20th European Photovoltaic Energy Conference*, Jun 2005.

T. M. Walsh, S.R. Wenham, and A.G. Aberle, "Novel Method for the Interconnection of Thin-Film Silicon Solar Cells on Glass," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 1229-1232, Jan 2005.

K.J. Weber, and A.W. Blakers, "A novel silicon texturization method based on etching through a silicon nitride mask," *Progress in Photovoltaics*, vol. 13, no. 8, pp. 691-695, Dec. 2005.

P.I. Widenborg, A. Straub, and A.G. Aberle, "Epitaxial thickening of AIC poly-Si seed

layers on glass by solid phase epitaxy," *Journal of Crystal Growth*, vol. 276, no. 1-2, pp. 19-28, Mar 2005.

D.N. Wright, E.S. Marstein, S. Ponce-Alcántara, C.D. Cañizo, and A. Holt, "Effect of Varying the PECVD Microwave Power in SiNx:H Deposition on the Effective Lifetime in Silicon," *15th International Photovoltaic Science & Engineering Conference*, Oct 2005.

V. Yelundur, K. Nakayashiki, M. Hilali, and A. Rohatgi, "Implementation of a Homogeneous High-Sheet-Resistance Emitter in Multicrystalline Silicon Solar Cells," *Conference Record of the Thirty-First IEEE Photovoltaic Specialists Conference*, pp. 959-962, Jan 2005.

## 2004

R.K. Ahrenkiel, and J. Dashdorj, "Interface recombination velocity measurement by a contactless microwave technique," *Journal of Vacuum Science & Technology B*, vol. 22, no. 4, pp. 2063-2067, Jul.-Aug. 2004.

M. Bähr, S. Dauwe, L. Mittelstädt, J. Schmidt, and G. Gobsch, "Surface Passivation and Contact Resistance on Various Emitters of Screen-Printed Crystalline Silicon Solar Cells," *19th European Photovoltaic Energy Conference*, Jun 2004.

A. Bentzen, E.S. Marstein, R. Kopecek, and A. Holt, "Phosphorus Diffusion and Gettering in Multi-Crystalline Silicon Solar Cell Processing," *19th European Photovoltaic Energy Conference*, Jun 2004.

J. Bisquert, D. Cahen, G. Hodes, S. Ruhle, and A. Zaban, "Physical chemical principles of photovoltaic conversion with nanoparticulate, mesoporous dye-sensitized solar cells," *Journal of Physical Chemistry B*, vol. 108, no. 24, pp. 8106-8118, Jun 2004.

K. Bothe, J. Schmidt, R. Hezel, R. Sinton, and T. Abe, "Limitations of the carrier lifetime in boron-doped oxygen-contaminated crystalline silicon," *19th European Photovoltaic Energy Conference*, Jun 2004.

S. Bowden, and R. A. Sinton, "Carrier Density in Lifetime Measurements of Silicon Blocks," *14th Workshop on Crystalline Silicon Solar Cells & Modules*, Aug 2004. 

Provides the theoretical background for using QSS measurements to measure blocks by using a weighted average carrier concentration.

D. Buie, M.J. McCann, K.J. Weber, and C.J. Dey, "Full day simulations of anti-reflection coatings for flat plate silicon photovoltaics," *Solar Energy Materials and Solar Cells*, vol. 81, no. 1, pp. 13-24, Jan 2004.

L.J. Caballero, C. del Cañizo, and A. Luque, "Experimental evaluation of p gettering process step on light induced degradation in cz si," *19th European Photovoltaic Energy Conference*, Jun 2004.

P.J. Cousins, D.H. Neuhaus, and J.E. Cotter, "Experimental verification of the effect of

depletion-region modulation on photoconductance lifetime measurements," *Journal of Applied Physics*, vol. 95, no. 4, pp. 1854-1858, Feb 2004.

A. Cuevas, and D. Macdonald, "Measuring and interpreting the lifetime of silicon wafers," *Solar Energy*, vol. 76, no. 1-3, pp. 255-262, 2004.

S. Daliento, A. Irace, L. Mele, and A. Sanseverino, "Quasi Steady-State and Transient PCD Lifetime Measurements in Silicon Materials for Photovoltaic Concentration Devices, a Comparison with the Transverse Probe Technique," *19th European Photovoltaic Energy Conference*, Jun 2004.

M. Dhamrin, H. Hashigami, K. Kamisako, T. Saitoh, T. Eguchi, T. Hirasawa, and I. Yamaga, "Extra-exceptional high carrier lifetimes in ga-doped mc-si wafers toward millisecond range," *19th European Photovoltaic Energy Conference*, Jun 2004.

P. Fath, E. Rueland, A. Schneider, S. Wansleben, and T. Pavelka, "Quality Control for Advanced Solar Cell Production Lines: the Wafer Incoming Inspection," *19th European Photovoltaic Energy Conference*, Jun 2004.

F. Ferrazza, M. Zarcone, L. Pirozzi, and S. De Iulii, "Factory Design Concepts: Process Yield Equation for a New High Efficiency Silicon Solar Cells Fabrication Process," *19th European Photovoltaic Energy Conference*, Jun 2004.

M. Garín, I. Martín, M. Vetter, A. Orpella, J. Puigdollers, C. Voz, and R. Alcubilla, "Fast Estimation of Surface Recombination Parameters in c-Si Passivated with Dielectric Films," *19th European Photovoltaic Energy Conference*, Jun 2004.

L.J. Geerligs, and D. Macdonald, "Dynamics of light-induced FeB pair dissociation in crystalline silicon," *Applied Physics Letters*, vol. 85, no. 22, pp. 5227-5229, Nov 2004.

J.H. Guo, and J.E. Cotter, "Laser-grooved backside contact solar cells with 680-mV open-circuit voltage," *IEEE Transactions on Electron Devices*, vol. 51, no. 12, pp. 2186-2192, Dec. 2004.

P. Hacke, J.S. Moschner, D. Yamanaka, and L. Meier, "Efficiency Optimization of the n+/n/p+ "Phostop" Cell," *19th European Photovoltaic Energy Conference*, Jun 2004.

M.M. Hilali, and A. Rohatgi, "Development of screen-printed silicon solar cells with high fill factors on 100 Omega/sq emitters," *IEEE Transactions on Electron Devices*, vol. 51, no. 6, pp. 948-955, Jun. 2004.

M. Hofmann, E. Schneiderlöchner, W. Wolke, and R. Preu, "Silicon Nitride-Silicon Oxide Stacks for Solar Cell Rear Side Passivation," *19th European Photovoltaic Energy Conference*, Jun 2004.

J. Hoorstra, A. van der Heide, A.W. Weeber, and F. Granek, "New Approach for Firing Optimisation in Crystalline Silicon Cell Technology," *19th European Photovoltaic Energy Conference*, Jun 2004.

C-J. Huang, C.T. Chen, C.S. Huang, S.C. Lin, M.T. Kuo, Y.R. Lin, and L.C. Kuo, "Development of C-Si Solar Cells for Low Illumination Applica," *19th European Photovoltaic Energy Conference*, Jun 2004.

H. Kampwerth, S. Rein, and S. Glunz, "Accurate Determination of Bulk Lifetime and Surface Recombination Velocity by a Comprehensive Thinning Experiment," *19th European Photovoltaic Energy Conference*, Jun 2004.

M.J. Kerr, and A. Cuevas, "Generalized analysis of the illumination intensity vs. open-circuit voltage of solar cells," *Solar Energy*, vol. 76, no. 1-3, pp. 263-267, 2004.

M.J. Kerr, and A. Cuevas, "Generalized analysis of the illumination intensity vs. open-circuit voltage of solar cells," *Solar Energy*, vol. 76, no. 1-4, pp. 263-267, Jan.-Mar. 2004.

Complete mathematical description of the SunsVoc measurement and correction for very high voltage devices.

V.K. Khanna, "Carrier lifetimes and recombination-generation mechanisms in semiconductor device physics," *European Journal of Physics*, vol. 25, no. 2, pp. 221-237, Mar. 2004.

G. Kumaravelu, M.M. Alkaisi, A. Bittar, D. Macdonald, and J. Zhao, "Damage studies in dry etched textured silicon surfaces," *Current Applied Physics*, vol. 4, no. 2-4, pp. 108-110, Apr. 2004.

M. Lozano, M. Ullan, C. Martinez, L. Fonseca, J.M. Rafi, F. Campabadal, E. Cabruja, C. Fleta, M. Key, and S. Bermejo, "Effect of combined oxygenation and gettering on minority carrier lifetime in high-resistivity FZ silicon," *Journal of the Electrochemical Society*, vol. 151, no. 10, pp. G652-G657, 2004.

A. Luque, I. Tobias, P. Gidon, M. Pirot, C. del Canizo, I. Anton, and C. Jausseaud, "Two-dimensional modeling of front contact silicon solar cells," *Progress in Photovoltaics*, vol. 12, no. 7, pp. 503-516, Nov. 2004.

D. H. Macdonald, L. J. Geerligs, and A. Azzizi, "Iron detection in crystalline silicon by carrier lifetime measurements for arbitrary injection and doping," *Journal of Applied Physics*, vol. 95, no. 3, pp. 1021, Feb 2004.

A model application for QSSPC to study SRH bulk recombination with practical implications. Uses the lifetime tester to measure the iron concentration in silicon.

D. Macdonald, P.N.K. Deenapanray, and S. Diez, "Onset of implant-related recombination in self-ion implanted and annealed crystalline silicon," *Journal of Applied Physics*, vol. 96, no. 7, pp. 3687-3691, Oct 2004.

D. Macdonald, and L. J. Geerligs, "Recombination activity of iron and other transition metals in p- and n-type crystalline silicon," *19th European Photovoltaic Energy Conference*, Jun 2004.

D. Macdonald, and L.J. Geerligs, "Recombination activity of interstitial iron and other transition metal point defects in p- and n-type crystalline silicon," *Applied Physics Letters*, vol. 85, no. 18, pp. 4061-4063, Nov 2004.

D. Macdonald, K. McLean, J. Mitchell, P.N.K. Deenapanray, and S. De Wolf, "An alternative scheme for implementing the impurity-photovoltaic effect in crystalline

silicon," *19th European Photovoltaic Energy Conference*, Jun 2004.

D.H. Macdonald, L.J. Geerligs, and A. Azzizi, "Iron detection in crystalline silicon by carrier lifetime measurements for arbitrary injection and doping," *Journal of Applied Physics*, vol. 95, no. 3, pp. 1021-1028, Feb 2004.

H. Mackel, and A. Cuevas, "The spectral response of the open-circuit voltage: a new characterization tool for solar cells," *Solar Energy Materials and Solar Cells*, vol. 81, no. 2, pp. 225-237, Feb 2004.

H. Mäckel, and A. Cuevas, "Temperature- and intensity-dependent voltage spectroscopy of recombination centres in silicon solar cells," *19th European Photovoltaic Energy Conference*, pp. 179-182, Jun 2004.

H. Mäckel, and A. Cuevas, "Extraction of the diffusion length of solar cells from the spectral response of the open-circuit voltage," *19th European Photovoltaic Energy Conference*, Jun 2004.

I. Martín, M. Vetter, A. Orpella, J. Puigdollers, C. Voz, R. Alcubilla, J. Damon Lacoste, and P. Roca i Cabarrocas, "Development of Emitters Based on a-Si (n+)/a-Si (i)/ c-Si (p) Heterojunctions Through Lifetime Spectroscopy," *19th European Photovoltaic Energy Conference*, Jun 2004.

A. Mohr, T. Roth, and S.W. Glunz, "Silicon Concentrator Cells With Compound Parabolic Concentrators," *19th European Photovoltaic Energy Conference*, Jun 2004.

J.D. Moschner, J. Henze, J. Schmidt, and R. Hezel, "High-quality surface passivation of silicon solar cells in an industrial-type inline plasma silicon nitride deposition system," *Progress in Photovoltaics*, vol. 12, no. 1, pp. 21-31, Jan. 2004.

K.A. Münzer, K-H. Eisenrith, A.M. Froitzheim, W.W. Krühler, R.E. Schlosser, R. Tölle, and M.G. Winstel, "Local BSF Contacts for High Efficiency Production Solar Cells," *19th European Photovoltaic Energy Conference*, Jun 2004.

L. Pérez, I. Freire, K. Varner, R. Lago, G. Bueno, and J.C. Jimeno, "Evaluation of the Recombination of Industrial Emitters Using Photoconductance Measurements," *19th European Photovoltaic Energy Conference*, Jun 2004.

T. Pisarkiewicz, "Photodecay method in investigation of materials and photovoltaic structures," *Opto-Electronics Review*, vol. 12, no. 1, pp. 33-40, Mar. 2004.

H. Plagwitz, M. Nerding, N. Ott, H. P. Strunk, and R. Brendel, "Low-Temperature Formation of Local Al Contacts to a-Si:H-passivated Si Wafers," *Progress in Photovoltaics*, vol. 12, pp. 47-54, 2004.

H. Plagwitz, M. Nerding, N. Ott, H.P. Strunk, and R. Brendel, "Low-temperature formation of local Al contacts to a-Si : H-passivated Si wafers," *Progress in Photovoltaics*, vol. 12, no. 1, pp. 47-54, Jan. 2004.

P. Pohl, and R. Brendel, "Temperature dependent infrared camera lifetime mapping (ILM)," *19th European Photovoltaic Energy Conference*, Jun 2004.

S. Riepe, M. Ghosh, A. Müller, H. Lautenschlager, D. Grote, W. Warta, and R. Schindler,

"Increased Wafer Yield For Solar Cells in Top and Bottom Regions of Cast Multicrystalline Silicon," *19th European Photovoltaic Energy Conference*, Jun 2004.

T. Roth, A. Mohr, and S.W. Glunz, "Fast Acquisition of the Characteristics of Silicon Concentrator Solar Cells," *19th European Photovoltaic Energy Conference*, Jun 2004.

J. Schmidt, "Light-induced degradation in crystalline silicon solar cells," *Gettering and Defect Engineering in Semiconductor Technology, SOLID STATE PHENOMENA*, (2004).


J. Schmidt, and K. Bothe, "Structure and transformation of the metastable boron- and oxygen-related defect center in crystalline silicon," *Physical Review B*, vol. 69, no. 2, Jan. 2004.

C. Schmiga, J. Schmidt, M. Ghosh, A. Metz, and R. Hezel, "Gettering and passivation of recombination centres in n-type multicrystalline silicon," *19th European Photovoltaic Energy Conference*, Jun 2004.


O. Schultz, S. Riepe, and S. W. Glunz, "Thermal degradation and gettering of solar grade multicrystalline silicon in cz si," *19th European Photovoltaic Energy Conference*, Jun 2004.

O. Schultz, S. Riepe, and S.W. Glunz, "Influence of high-temperature processes on multicrystalline silicon," *Gettering and Defect Engineering in Semiconductor Technology, SOLID STATE PHENOMENA*, (2004).

R. A. Sinton, "Evaluating silicon blocks and ingots with quasi-steady-state and transient lifetime measurements," *14th Workshop on Crystalline Silicon Solar Cells & Modules*, Aug 2004.

R. A. Sinton, T. Mankad, S. Bowden, and N. Enjalbert, "Evaluating Silicon Blocks and Ingots With Quasi-Steady-State Lifetime Measurements," *19th European Photovoltaic Energy Conference*, 2004. 

Demonstrates how to measure iron concentration in silicon blocks and determine how the wafers will perform during processing.

R. A. Sinton, H. Tathgar, S. Bowden, and A. Cuevas, "On the Problem of Determining the Bulk Lifetime of Unpassivated Silicon Wafers," *14th Workshop on Crystalline Silicon Solar Cells & Modules*, Aug 2004. 

Discusses how to get useful lifetime measurement on raw wafers without any sample preparation.

A. Slade, R. Gordon, and V. Garboushian, "Issues Encountered in the Manufacture of 125  $\mu\text{m}$  Thick, 26% Efficient Silicon Solar Cells in Microelectronics Foundries," *19th European Photovoltaic Energy Conference*, Jun 2004.

D. Song, A. Straub, P. Widenborg, B. Vogl, P. Campbell, Y. Huang, and A.G. Aberle, "Polycrystalline Silicon Thin-Film Solar Cells on Glass by Solid Phase Crystallization of In-Situ Doped Evaporated a-Si," *19th European Photovoltaic Energy Conference*, Jun 2004.

- A. Straub, N.P. Harder, Y.D. Huang, and A.G. Aberle, "High-quality homo-epitaxial silicon growth in a non-ultra-high vacuum environment by ion-assisted deposition," *Journal of Crystal Growth*, vol. 268, no. 1-2, pp. 41-51, Jul 2004.
- T. Trupke, and R.A. Bardos, "Self-consistent determination of the generation rate from photoconductance measurements," *Applied Physics Letters*, vol. 85, no. 16, pp. 3611-3613, Oct 2004.
- T. Trupke, R.A. Bardos, F. Hudert, P. Würfel, J. Zhao, A. Wang, and M.A. Green, "Effective Excess Carrier Lifetimes Exceeding 100 Milliseconds in Float Zone Silicon Determined from Photoluminescence," *19th European Photovoltaic Energy Conference*, Jun 2004.
- A. Upadhyaya, M. Sheoran, A. Rohatgi, and K. Matthei, "Record High Efficiency Screen-Printed Belt Co-Fired Cells on Cast Multicrystalline Silicon," *19th European Photovoltaic Energy Conference*, Jun 2004.
- J. Vedde, L. Jensen, T. Larsen, and T. Clausen, "PV-FZ® - a Cost Effective Route to High Efficiency Solar Cells?," *19th European Photovoltaic Energy Conference*, Jun 2004.
- M. Vetter, R. Ferré, A. Orpella, I. Martín, J. Puigdollers, C. Voz, and R. Alcubilla, "Development of Solar Cells with Annealed a-Si<sub>0,8</sub>C<sub>0,2</sub>/c-Si Emitter," *19th European Photovoltaic Energy Conference*, Jun 2004.
- C. Voz, D. Muñoz, I. Martin, A. Orpella, M. Vetter, J. Puigdollers, R. Alcubilla, M. Fonrodona, D. Soler, J. Bertomeu, and J. Andreu, "Bifacial Heterostructures with Thin Amorphous Silicon Films Deposited by Hot-Wire CVD on Crystalline Silicon for Solar Cell Applications," *19th European Photovoltaic Energy Conference*, Jun 2004.
- A.W. Weeber, A.R. Burgers, M.J.A.A. Goris, M. Koppes, E.J. Kossen, H.C. Rieffe, W.J. Soppe, C.J.J. Tool, and J.H. Bultman, "16% MC-SI Cell Efficiencies Using Industrial In-Line Processing," *19th European Photovoltaic Energy Conference*, Jun 2004.
- A.W. Weeber, H.S. Rieffe, W.C. Sinke, and W.J. Soppe, "Structural and Passivating Properties of SiN<sub>x</sub>:H Deposited Using Different Precursor Gases," *19th European Photovoltaic Energy Conference*, Jun 2004.
- A.W. Weeber, H. Tathgar, F. Huster, M.J.A.A. Goris, L.J. Geerligts, O. Gjerstad, B. Terheiden, M. McCann, and P. Fath, "High-Quality Mc-Si Wafers for High-Efficiency Solar Cells," *19th European Photovoltaic Energy Conference*, Jun 2004.
- S. Winderbaum, A. Cuevas, F. Chen, J. Tan, K. Hanton, D. Macdonald, and K. Roth, "Industrial PECVD Silicon Nitride: Surface and Bulk Passivation of Silicon Wafers," *19th European Photovoltaic Energy Conference*, Jun 2004.
- H.H. Zhao, "Recent advances of high-efficiency single crystalline silicon solar cells in processing technologies and substrate materials," *Solar Energy Materials and Solar Cells*, vol. 82, no. 1-2, pp. 53-64, May 2004.



## 2003

A. Azzizi, L. J. Geerligs, and A. R. Burgers, "Analysis of Cell-Process Induced Changes in Multicrystalline Silicon," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

M.S. Carrol, and C. A. King, "Dependence of the electron minority carrier lifetime on interstitial oxygen and substitutional carbon in pseudomorphically strained SiGeC heterostructures," *Journal of Applied Physics*, vol. 93, no. 3, pp. 1656-1660, Feb 2003.

An example of the use of QSSPC to characterize Si:Ge epi layers on silicon wafers.

T. Clausen, J. Vedde, L. Jensen, A. Nielsen, O. Andersen, T.L. Larsen, and A.M. Jørgensen, "Thin Silicon Solar Cells Fabricated on Cost Optimized Float Zone Silicon," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

G. Coletti, M. Galluppi, S. De Iuliis, and F. Ferrazza, "Solar Cells In-Line Characterisation for Industrial Process," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

A. Cuevas, and R. Sinton, "Characterization and Diagnosis of Silicon Wafers and Devices," *Practical Handbook of Photovoltaics: Fundamentals and Applications*, Tom Markvart and Luis Castaner, Editors, Elsevier, Ltd., 2003.

Overview of QSSPC analysis and applications in a handbook format.

S. Dauwe, L. Mittelstädt, A. Metz, J. Schmidt, and R. Hezel, "Low-Temperature Rear Surface Passivation Schemes for >20% Efficiency Silicon Solar Cells," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

S. De Wolf, H.F.W. Dekkers, G. Agostinelli, and J. Szlufcik, "Novel Concept for Thin Multi-Crystalline Silicon Solar Cell Process," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

M. Dhamrin, Y. Kayamori, H. Hashigami, and T. Saitoh, "Metastability in Boron-Doped Multicrystalline Silicon Wafers and Solar Cells," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

G. Emanuel, W. Wolke, and R. Preu, "Lifetime Improvements of Multicrystalline Silicon Analysed by Spatially Resolved Lifetime Measurements," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

B. Fischer, "Loss Analysis of Crystalline Silicon Solar Cells using Photoconductance and Quantum Efficiency Measurements," *Dissertation, University Konstanz*, Mar. 2003.

L. J. Geerligs, "Impact of Defect distribution and Impurities on Multicrystalline Silicon Cell Efficiency," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

L. J. Geerligs, A. Azzizi, D. H. Macdonald, and P. Manshanden, "Hydrogen passivation of iron in multicrystalline silicon," *Proceedings 13th Workshop on Crystalline Silicon Solar Cell Materials and Processes*, 2003.

S. W. Glunz, A. Grohe, M. Hermle, E. Schneiderlöchner, J. Dicker, R. Preu, H. Mäckel, D. Macdonald, and A. Cuevas, "Analysis of Laser-Fired Local Back Surface Fields Using  $n^{+}np^{+}$  Cell Structures," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

N.P. Harder, A.B. Sproul, T. Brammer, and A. G. Aberle, "Impact of Sheet Resistance and Contact Shading on "Suns-Voc" Measurements on Thin-Film Solar Cells," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

H. Hashigami, and T. Saitoh, "Carrier-Induced Degradation Phenomena of Carrier Lifetime and Cell Performance in Boron-Doped CZ-Si," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

H. Kampwerth, S. Rein, and S. W. Glunz, "Pure Experimental Determination of Surface Recombination Properties with High Reliability," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

D.S. Kim, A.M. Gabor, V. elundur, A.D. padhyaya, V. eemongkolkiat, and A. Rohatgi, "String Ribbon silicon solar Cells With 17.8% Efficiency," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

D. Kray, J. Dicker, D. Osswald, A. Leimenstoll, S. W. Glunz, W. Zimmermann, K.-H. Tentscher, and G. Strobl, "Progress in High-Efficiency Emitter-Wrapthrough Cells on Medium Quality Substrates," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

D. Kray, H. Kampwerth, A. Leimenstoll, S. W. Glunz, and G. P. Willeke, "Analysis of Very-Thin High Efficiency Solar Cells," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

D. Macdonald, A. Cheung, and A. Cuevas, "Gettering and Poisoning of Silicon Wafers by Phosphorus Diffused Layers," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

D. Macdonald, and A. Cuevas, "Validity of Shockley-Read-Hall statistics for modeling carrier lifetimes in silicon," *Physical Review B*, vol. 67, 2003.

D. Macdonald, A. Cuevas, S. Rein, P. Lichtner, and S.W. Glunz, "Temperature- and Injection-Dependent Lifetime Spectroscopy of Copper-Related Defects in Silicon," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

H. Mäckel, and A. Cuevas, "Determination of the Surface Recombination Velocity of Unpassivated silicon from Spectral Photoconductance Measurements," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

H. Mäckel, and A. Cuevas, "The Spectral Response of the Open-Circuit Voltage: A New Technique for Solar Cell Characterization," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

M. McCann, K. Weber, and A. Blakers, "An Early-Deposited LPCVD Silicon Nitride: Allowing the Possibility of Novel Cell Designs," *3rd World Conference on Photovoltaic*

*Energy Conversion*, May 2003.

D. L. Meier, P. Hacke, J. A. Jessup, S. Yamanaka, J. Salami, N. Ishikawa, M. Emoto, and T. Mishima, "Factors Affecting the Performance of Thin Dendritic Web Silicon Front Surface Field (n+np+) Solar Cells," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

Suns-Voc used in the optimization of emitter sheet resistance in a front surface field (FSF) cell structure

D.H. Neuhaus, P.J. Cousins, and A.G. Aberle, "Trapping and Junction-Related Perturbations of the Effective Excess Carrier Lifetime," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

Discusses the effect of changes in the width of the depletion region on steady state measurements at low injection levels of around  $1e13 \text{ cm}^{-3}$

U. Rau, V. X. Nguyen, J. Mattheis, M. Rakhlin, and J. H. Werner, "Recombination at a-Si:H/c-Si Heterointerfaces and In a-si:H/c-Si Heterojunction Solar Cells," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

S. Rein, P. Lichtner, and S.W. Glunz, "Advanced Lifetime Spectroscopy: Unambiguous Determination of the Electronic Properties of the Metastable Defect in Boron-Doped Cz-Si," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

J. Schmidt, "Temperature- and injection-dependent lifetime spectroscopy for the characterization of defect centers in semiconductors," *Applied Physics Letters*, vol. 82, no. 13, pp. 2178-2180, Mar 2003.

Generalization of QSSPC for temperature-dependent measurements.

J. Schmidt, K. Bothe, and R. Hezel, "Structure and Transformation of the Metastable Centre in CZ-Silicon Solar Cells," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

J. Schmidt, and R.A. Sinton, "Defect Characterization by Temperature and Injection-Dependent Lifetime Spectroscopy," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

R.A. Sinton, "Practical measurement of Bulk Lifetime and Surface Recombination by Using Wavelength Dependence," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

R.A. Sinton, "Predicting Multi-Crystalline Solar Cell Efficiency from Lifetime," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

S. Stepanov, and S. Ruschin, "Modulation of light by light in silicon-on-insulator waveguides," *Applied Physics Letters*, vol. 83, no. 25, pp. 5151-5153, Dec 2003.

A.S.H. van der Heide, J.H. Bultman, M.J.A.A. Goris, and J. Hoornstra, "Influence of Grain Orientation on Contact Resistance at Higher Emitter Resistances, Investigated for Alkaline and Acid Saw Damage Removal," *3rd World Conference on Photovoltaic*

*Energy Conversion*, May 2003.

J. Vedde, T. Clausen, and L. Jensen, "Float-Zone Silicon for High Volume Production of Solar Cells," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

M. Vetter, I. Martín, A. Orpella, J. Puigdollers, C. Voz, and R. Alcubilla, "Solar Cells with Annealed Amorphous SiO<sub>2</sub>/Si Heterojunction and a-siC<sub>x</sub>:H Backsurface Passivation," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

C. Voz, I. Martin, A. Orpella, M. Vetter, J. Puigdollers, R. Alcubilla, D. Soler, M. Fonrodona, J. Bertomeu, and J. Andreu, "Hot-Wire CVD Thin Silicon Films on Crystalline Silicon for Solar Cell Applications," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

A.W. Weeber, H.C. Rieffe, M.J.A.A. Goris, J. Hong, W.M.M. Kessels, M.C. van de Sanden, and W.J. Soppe, "Improved Thermally Stable Surface and Bulk Passivation of PECVD SiNX:H Using N<sub>2</sub> and SiH<sub>4</sub>," *3rd World Conference on Photovoltaic Energy Conversion*, May 2003.

## 2002

K. Bothe, J. Schmidt, and R. Hezel, "Effective reduction of the metastable defect concentration in boron-doped czochralski silicon for solar cells," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 194-197, 2002.

S. Bowden, D.S. Kim, C. Honsberg, and A. Rohatgi, "Rapid thermal processing for front and rear contact passivation using a large area deposition system," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 410-413, 2002.

S. Bowden, V. Yelundur, and A. Rohatgi, "Implied-Voc And Suns-Voc Measurements In Multicrystalline Solar Cells," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 371-374, 2002.

R. Brendel, M. Bail, B. Bodmann, et al., "Analysis of photoexcited charge carrier density profiles in Si wafers by using an infrared camera," *Applied Physics Letters*, vol. 80, no. 3, pp. 437-439, Jan 2002.

J. Brody, and A. Rohatgi, "Sensitivity analysis of two-spectrum separation of surface and bulk components of minority carrier lifetimes," *Solid State Electronics*, vol. 46, no. 6, pp. 859-866, Jun. 2002.

J. Brody, and A. Rohatgi, "Comparison of dielectric surface passivation of monocrystalline and multicrystalline silicon," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 243-246, 2002.

R. Bruggemann, and J.P. Kleider, "Photoconductivity techniques for defect spectroscopy of photovoltaic materials," *Thin Solid Films*, vol. 403-404, pp. 30-33, 2002.

G. Coletti, S. De Iuliis, M. Galluppi, and F. Ferrazza, "A Method For Industrial Characterisation Of Crystalline Silicon Wafers," *Conference Record of the Twenty Ninth*

*IEEE Photovoltaic Specialists Conference*, pp. 270-273, 2002.

A. Cuevas, M.J. Kerr, C. Samundsett, F. Ferrazza, and G. Coletti, "Millisecond minority carrier lifetimes in n-type multicrystalline silicon," *Applied Physics Letters*, vol. 81, no. 26, pp. 4952-4954, 2002.

A. Cuevas, R.A. Sinton, M. Kerr, D. Macdonald, and H. Mackel, "A contactless photoconductance technique to evaluate the quantum efficiency of solar cell emitters," *Solar Energy Materials and Solar Cells*, vol. 71, no. 3, pp. 295-312, Feb 2002.

B. Damiani, M. Hilali, and A. Rohatgi, "Light induced degradation in czochralski silicon during illuminated high temperature processing," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 348-351, 2002.

S. Dauwe, J. Schmidt, and R. Hezel, "Very low surface recombination velocities on p- and n-type silicon wafers passivated with hydrogenated amorphous silicon films," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 1246-1249, 2002.

S. Dauwe, J. Schmidt, A. Metz, and R. Hezel, "Fixed charge density in silicon nitride films on crystalline silicon surfaces under illumination," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 162-165, 2002.

M.J.A.A. Goris, A.W. Weeber, and J.H. Bultman, "Narrower Efficiency Distribution for Multicrystalline Silicon Solar Cells by Double-side Emitter Diffusion," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 379-382, 2002.

P. Hacke, and D. L. Meier, "Analysis Of Fill Factor Losses Using Current-Voltage Curves Obtained Under Dark And Illuminated Conditions," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 462-464, 2002.

M. Hilali, J.W. Jeong, A. Rohatgi, D. L. Meier, and A. F. Carroll, "Optimization of self-doping ag paste firing to achieve high fill factors on screen- printed silicon solar cells with a 100 ohm/sq. emitter," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 356-359, 2002.

J. Isenberg, S. Riepe, S.W. Glunz, and W. Warta, "Carrier Density Imaging (CDI): A Spatially Resolved Lifetime Measurement Suitable for In-Line Process-Control," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 266-269, 2002.

M. Kerr, "Surface, Emitter and Bulk Recombination in Silicon and Development of Silicon Nitride Passivated Solar Cells," *Ph.D Thesis*, 2002.

M.J. Kerr, "Surface, Emitter, and Bulk Recombination in Silicon and Development of Silicon Nitride Passivated Solar Cells," *Ph.D. Thesis, Australian National University*, Jun. 2002.

M.J. Kerr, P. Campbell, and A. Cuevas, "Lifetime and efficiency limits of crystalline silicon solar cells," *Conference Record of the Twenty Ninth IEEE Photovoltaic*

*Specialists Conference*, pp. 438-441, 2002.

M.J. Kerr, and A. Cuevas, "Recombination at the interface between silicon and stoichiometric plasma silicon nitride," *Semiconductor Science Technology*, vol. 17, no. 2, pp. 166-172, Feb. 2002.

M.J. Kerr, and A. Cuevas, "Very low bulk and surface recombination in oxidized silicon wafers," *Semiconductor Science Technology*, vol. 17, no. 1, pp. 35-38, Jan. 2002.

M.J. Kerr, and A. Cuevas, "Recombination at the interface between silicon and stoichiometric plasma silicon nitride," *Semiconductor Science Technology*, vol. 17, no. 2, pp. 166-172, Feb. 2002.

M.J. Kerr, and A. Cuevas, "General parameterization of Auger recombination in crystalline silicon," *Journal of Applied Physics*, vol. 91, no. 4, pp. 2473-2480, Feb 2002.

M.J. Kerr, and A. Cuevas, "Comprehensive study of the doping and injection-level dependence of stoichiometric silicon nitride passivation for silicon solar cells," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, 2002.

M.J. Kerr, A. Cuevas, and R.A. Sinton, "Generalized analysis of quasi-steady-state and transient decay open circuit voltage measurements," *Journal of Applied Physics*, vol. 91, no. 1, pp. 399-404, Jan 2002.

Generalization of QSSVOC math to cover cases from Steady-state to OCVD (transient) measurements.

W. Kintzel, M. Bail, R. Auer, and R. Brendel, "Efficient surface passivation by silicon nitride using a large area deposition system," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 262-265, 2002.

D. Macdonald, A. Cuevas, A. Kinomura, and Y. Nakano, "Phosphorus gettering in multicrystalline silicon studied by neutron activation analysis," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 285-288, 2002.

L. Mittelstadt, A. Metz, and R. Hezel, "Hydrogen passivation of defects in EFG ribbon silicon," *Solar Energy Materials and Solar Cells*, vol. 72, pp. 255-261, Apr. 2002.

D.H. Neuhaus, N.P. Harder, S. Oelting, et al., "Dependence of the recombination in thin-film Si solar cells grown by ion-assisted deposition on the crystallographic orientation of the substrate," *Solar Energy Materials and Solar Cells*, vol. 74, pp. 225-232, Oct. 2002.

S. Rein, P. Lichtner, W. Warta, and S.W. Glunz, "Advanced Defect Characterization by Combining Temperature- and Injection-Dependent Lifetime Spectroscopy (TDLA and IDLS)," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 190-193, 2002.

S. Rein, T. Rehr, W. Warta, et al., "Lifetime spectroscopy for defect characterization: Systematic analysis of the possibilities and restrictions," *Journal of Applied Physics*, vol. 91, no. 4, pp. 2059-2070, Feb 2002.

S. Rein, T. Rehr, W. Warta, and S. W. Glunz, "Lifetime spectroscopy for defect characterization: Systematic analysis of the possibilities and restrictions," *Journal of*

*Applied Physics*, vol. 91, no. 3, pp. 2059, Feb 2002.

J. Schmidt, K. Bothe, and R. Hezel, "Oxygen-related minority-carrier trapping centers in p-type Czochralski silicon," *Applied Physics Letters*, vol. 80, no. 23, pp. 4395-4397, Jun 2002.

J. Schmidt, K. Bothe, and R. Hezel, "Formation and annihilation of the metastable defect in boron-doped czochralski silicon," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 178-181, 2002.

W. J. Soppe, J. ong, W.M.M. Kessels, M.C.M. van de Sanden, W.M. Arnoldbik, H. Schlemm, C. Devilée, H. Rieffe, S.E.A. Schiermeier, J.H. Bultman, and A.W. Weeber, "On combining surface and bulk passivation of SiNx:H layers for mc-Si solar cells," *Conference Record of the Twenty Ninth IEEE Photovoltaic Specialists Conference*, pp. 158-161, 2002.

W. Warta, "Defect and impurity diagnostics and process monitoring," *Solar Energy Materials and Solar Cells*, vol. 72, no. 1-4, pp. 389-401, Apr. 2002.

## **2001**

C. Ballif, S. Peters, and D. Borchert, "Lifetime Mapping of Solar Cells and Control of the Effective Surface Recombination Velocity by Application of a Bias Voltage," *17th European Photovoltaic Solar Energy Conference*, pp. 1408-1411, Oct 2001.

S. Bowden, and A. Rohatgi, "Rapid and Accurate Determination of Series Resistance and Fill Factor Losses in Industrial Silicon Solar Cells," *17th European Photovoltaic Solar Energy Conference*, pp. 1802-1806, Oct 2001.

Comparison of the Suns Voc method with curve fitting the double diode model.

J. Brody, A. Rohatgi, and A. Ristow, "Guidelines for more accurate determination and interpretation of effective lifetime from measured quasi-steady-state photoconductance," *Proceedings 11th Workshop on Crystalline Silicon Solar Cell Materials and Processes*, 2001.

G. Bueno, V. Rodríguez, F. Hernando, J.C. Jimeno, F. Recart, and R. Gutiérrez, "Characterization of Volume and Surface Recombination in Industrial Solar Cell Precursors by the Effective Lifetime Reconstruction in Variable Injection," *17th European Photovoltaic Solar Energy Conference*, Oct 2001.

A. Castaldini, D. Cavalcoli, A. Cavallini, M. Rossi, M. Spiegel, and T. Pernau, "Minority Carrier Lifetimes of Multicrystalline SI Obtained from Different Methods: A Comparison," *17th European Photovoltaic Solar Energy Conference*, pp. 1921-1924, Oct 2001.

G. Coletti, S. De Iuliis, and F. Ferrazza, "A New Approach to Measure Multicrystalline Silicon Solar Cells in a Production Process," *17th European Photovoltaic Solar Energy Conference*, pp. 1640-1642, Oct 2001.

C. Del Cañizo, A. El Moussaoui, I. Tobías, and A. Luque, "Non-Uniform Lifetime Profiles in Silicon Solar Cells," *17th European Photovoltaic Solar Energy Conference*, pp. 1523-1526, Oct 2001.

M.J. Kerr, and A. Cuevas, "Generalisation of the illumination intensity vs. open-circuit voltage characteristics of solar cells," *17th European Photovoltaic Solar Energy Conference*, pp. 300-303, Oct 2001.

Description of the SunsVoc measurement and correction for very high voltage devices.

M.J. Kerr, and A. Cuevas, "Record High Minority Carrier Lifetimes in Processed Silicon Wafers," *17th European Photovoltaic Solar Energy Conference*, pp. 304-307, Oct 2001.

M.J. Kerr, J. Schmidt, A. Cuevas, et al., "Surface recombination velocity of phosphorus-diffused silicon solar cell emitters passivated with plasma enhanced chemical vapor deposited silicon nitride and thermal silicon oxide," *Journal of Applied Physics*, vol. 89, no. 7, pp. 3821-3826, Apr 2001.

R. Lago-Aurrekoetxea, I. Tobias, C. del Canizo, et al., "Lifetime measurements by photoconductance techniques in wafers immersed in a passivating liquid," *Journal of the Electrochemical Society*, vol. 148, no. 4, pp. G200-G206, Apr. 2001.

D. Macdonald, and A. Cuevas, "Comment on "Mechanisms for the anomalous dependence of carrier lifetime on injection level and photoconductance on light intensity"," *Journal of Applied Physics*, vol. 90, no. 5, pp. 2621-2622, Sep 2001.

D. Macdonald, and A. Cuevas, "Understanding carrier trapping in multicrystalline silicon," *Solar Energy Materials and Solar Cells*, vol. 65, no. 1-4, pp. 509-516, Jan. 2001.

D. Macdonald, A. Cuevas, and J. Wong-Leung, "Capture cross sections of the acceptor level of iron-boron pairs in p-type silicon by injection-level dependent lifetime measurements," *Journal of Applied Physics*, vol. 89, no. 12, pp. 7932-7939, Jun 2001.

D. Macdonald, R.A. Sinton, and A. Cuevas, "On the use of a bias-light correction for trapping effects in photoconductance-based lifetime measurements of silicon," *Journal of Applied Physics*, vol. 89, no. 5, pp. 2772-8, Mar 2001.

D.H. Macdonald, "Recombination and Trapping in Multicrystalline Silicon Solar Cells," *Ph.D. Thesis, Australian National University*, May 2001.

I. Martin, M. Vetter, A. Orpella, et al., "Surface passivation of p-type crystalline Si by plasma enhanced chemical vapor deposited amorphous SiC<sub>x</sub> : H films," *Applied Physics Letters*, vol. 79, no. 14, pp. 2199-2201, Oct 2001.

I. Martín, M. Vetter, A. Orpella, C. Voz, J. Puigdollers, and R. Alcubilla, "Characterization of p-Type c-Si Surface Passivation by n-Doped a-SiC<sub>x</sub>:H Films," *17th European Photovoltaic Solar Energy Conference*, pp. 2954-2957, Oct 2001.

D.H. Neuhaus, P.P. Altermatt, A.B. Sproul, R.A. Sinton, A. Schenk, A. Wang, and A.G. Aberle, "Method for measuring minority and majority carrier mobilities in solar cells wafers passivated with hydrogenated amorphous silicon films," *17th European*



*Photovoltaic Solar Energy Conference*, pp. 242-245, Oct 2001.

S. Rein, T. Rehr, W. Warta, S.W. Glunz, and G. Willeke, "Electrical and Thermal Properties of the Metastable Defect in Boron-Doped Czochralski Silicon (Cz-Si)," *17th European Photovoltaic Solar Energy Conference*, pp. 1555-1560, Oct 2001.

S. Riepe, J. Isenberg, C. Ballif, S.W. Glunz, and W. Warta, "Carrier Density and Lifetime Imaging of Silicon Wafers by Infrared Lock-In Thermography," *17th European Photovoltaic Solar Energy Conference*, pp. 1597-1599, Oct 2001.

J. Schmidt, A. Cuevas, S. Rein, and S.W. Glunz, "Fill Factor Limitations and Non-Ideal Diode Behaviour of Czochralski Silicon Solar Cells Due to Light-Induced Recombination Centres," *17th European Photovoltaic Solar Energy Conference*, pp. 1396-1399, Oct 2001.

J. Schmidt, and M. Kerr, "Highest-quality surface passivation of low-resistivity p-type silicon using stoichiometric PECVD silicon nitride," *Solar Energy Materials and Solar Cells*, vol. 65, no. 1-4, pp. 585-591, Jan. 2001.

J. Schmidt, M. Kerr, and A. Cuevas, "Surface passivation of silicon solar cells using plasma-enhanced chemical-vapour-deposited SiN films and thin thermal SiO<sub>2</sub>/plasma SiN stacks," *Semiconductor Science Technology*, vol. 16, no. 3, pp. 164-170, Mar. 2001.

W.J. Soppe, C. Devilée, A.W. Weeber, S.E.A. Schiermeier, J. Hong, W.M.M. Kessels, M.C.M. Van de Sanden, and W.M. Arnoldbik, "Bulk and Surface Passivation by Silicon Nitride Grown by Remote Microwave PECVD," *17th European Photovoltaic Solar Energy Conference*, pp. 1543-1546, Oct 2001.

K. Stewart, A. Cuevas, D. Macdonald, and J. Williams, "Influence of copper on the carrier lifetime of n-type and p-type silicon.," *Proceedings 11th Workshop on Crystalline Silicon Solar Cell Materials and Processes*, pp. 24-31, 2001.

## **2000**

M. Bail, and R. Brendel, "Separation of Bulk and Surface Recombination by Steady State Photoconductance Measurements," *Proc of the 16th European Photovoltaic Solar Energy Conference*, May 2000.

A very nice application note for using 2 wavelengths of light for separating surface and bulk recombination

G. Bueno, F. Recart, F. Hernando, V. Rodriguez, R. Gutierrez, and J. C. Jimeno, "Lifetime Improvement in Screen-Printed Bifacial Solar Cells on CZ Substrates," *16th European Photovoltaic Solar Energy Conference*, 2000.

A. Cuevas, M. Kerr, D. Macdonald, and R.A. Sinton, "Emitter quantum efficiency from contactless photoconductance measurements," *Conference Record of the Twenty-Eighth IEEE Photovoltaic Specialists Conference*, pp. 108-111, Sep 2000.

M. Kerr, J. Schmidt, and A. Cuevas, "Comparison of the open circuit voltage of

simplified PERC cells passivated with PECVD silicon nitride and thermal silicon oxide," *Progress in Photovoltaics: Research and Applications*, vol. 8, no. 5, pp. 529-536, Sep.-Oct. 2000.

R. Lago-Aurrekoetxia, C. del Canizo, I. Tobias, and A. Luque, "Applications of Contactless Lifetime Measurements to Discriminate Gettering and BSF Effects in Solar Cells," *16th European Photovoltaic Solar Energy Conference*, vol. 1, no. 1, pp. an Photovoltaic Solar Energy Conference, Glasgow, Scotland, 1-5 May 2000, 2000.

D. MacDonald, and A. Cuevas, "Reduced fill factors in multicrystalline silicon solar cells due to injection-level dependent bulk recombination lifetimes," *Progress in Photovoltaics: Research and Applications*, vol. 8, no. 4, pp. 363-375, Jul.-Aug. 2000.

D. Macdonald, and A. Cuevas, "The trade-off between phosphorus gettering and thermal degradation in multicrystalline silicon," *Proc of the 16th European Photovoltaic Solar Energy Conference*, 2000.

D. MacDonald, and A. Cuevas, "Reduced fill factors in multicrystalline silicon solar cells due to injection-level dependent bulk recombination lifetimes," *Progress in Photovoltaics*, vol. 8, pp. 363-375, 2000.

Describes how changes in the bulk lifetime will lower the fill factor of multicrystalline silicon solar cells.

D. Macdonald, A. Cuevas, M. Kerr, C. Samundsett, A. Sloan, A. Leo, M. Mrcarica, S. Winderbaum, and S. Shea, "Characterisation of a Commercial Silicon Solar Cell Fabrication Process," *Proceedings of the 38th Annual Australian and New Zealand Solar Energy Conference*, pp. 430-436, 2000.

H. Nagel, B. Lenkeit, R.A. Sinton, A. Metz, and R. Hezel, "Relationship between effective carrier lifetimes in silicon determined under steady-state and transient illumination," *Proc of the 16th European Photovoltaic Solar Energy Conference*, 2000.


T. Saitoh, H. Hashigami, S. Rein, et al., "Overview of light degradation research on crystalline silicon solar cells," *Progress in Photovoltaics: Research and Applications*, vol. 8, no. 5, pp. 537-547, Sep.-Oct. 2000.

J. Schmidt, M. Kerr, and P.P. Altermatt, "Coulomb-enhanced Auger recombination in crystalline silicon at intermediate and high-injection densities," *Journal of Applied Physics*, vol. 88, no. 3, pp. 1494-1497, Aug 2000.

R.A. Sinton, and A. Cuevas, "A Quasi-Steady-State Open-Circuit Voltage Method for Solar Cell Characterization," *16th European Photovoltaic Solar Energy Conference*, 2000. 

The first major reference for the QSSVOC technique.

## 1999


- A. Cuevas, "The effect of emitter recombination on the effective lifetime of silicon wafers," *Solar Energy Materials and Solar cells*, vol. 57, pp. 277-290, 1999.
- A. Cuevas, M. Stocks, D. Macdonald, M. Kerr, and C. Samundsett, "Recombination and Trapping in Multicrystalline Silicon," *IEEE Transactions on Electron Devices*, vol. 46, no. 10, pp. 2026-2034, Oct. 1999.
- S.W. Glunz, D. Biro, S. Rein, et al., "Field-effect passivation of the SiO<sub>2</sub>-Si interface," *Journal of Applied Physics*, vol. 86, no. 1, pp. 683-691, Jul 1999.
- D. Macdonald, and A. Cuevas, "Trapping of minority carriers in multicrystalline silicon," *Applied Physics Letters*, vol. 74, no. 12, pp. 1710-1712, Mar 1999.
- D. Macdonald, A. Cuevas, and F. Ferrazza, "Response to phosphorus gettering of different regions of cast multicrystalline silicon ingots," *Solid State Electronics*, vol. 43, no. 3, pp. 575-581, Mar. 1999.
- D. Macdonald, M. Kerr, and A. Cuevas, "Boron-related minority-carrier trapping centers in p-type silicon," *Applied Physics Letters*, vol. 75, no. 11, pp. 1571-1573, Sep 1999.
- H. Nagel, C. Berge, and A.G. Aberle, "Generalized analysis of quasi-steady-state and quasi-transient measurements of carrier lifetimes in semiconductors," *Journal of Applied Physics*, vol. 86, no. 11, pp. 6218-6221, Dec 1999.
- The math for analyzing data using the fully time dependent solutions rather than the steady-state or transient limits.
- J. Schmidt, "Measurement of differential and actual recombination parameters on crystalline silicon wafers," *IEEE Transactions on Electron Devices*, vol. 46, no. 10, pp. 2018-2025, Oct. 1999.
- J. Schmidt, and A. Cuevas, "Electronic properties of light-induced recombination centers in boron-doped Czochralski silicon," *Journal of Applied Physics*, vol. 86, no. 6, pp. 3175-3180, Sep 1999.
- R. A. Sinton, "Possibilities for Process-Control Monitoring of Electronic Material Properties During Solar Cell Manufacture," *NREL 9th Workshop on Crystalline Silicon Solar Cells and Materials and Processes*, Aug 1999. 

Covers the practical use of SunsVoc and lifetime testers at various stages during cell processing.

## 1998

- C. Berge, J. Schmidt, B. Lenkeit, H. Nagel, and A.G. Aberle, "Comparison of Effective Carrier Lifetimes in Silicon Determined by Transient and Quasi-Steady-State Photoconductance Measurements," *2nd World Conference on Photovoltaic Solar Energy Conversion*, pp. 1426-1429, 1998.

A. Cuevas, "Lifetime studies of multicrystalline silicon," *Proceedings of the 8th workshop on crystalline silicon solar cell materials and processes.*, pp. 50-59, Aug. 1998.

A. Cuevas, M. Stocks, D. Macdonald, and R. Sinton, "Applications of the Quas-Steady-State Photoconductance Technique," *2nd World Conference on Photovoltaic Solar Energy Conversion*, pp. 1236-1241, 1998. 

Review of early results from studies using QSSPC

J. Schmidt, C. Berge, and A.G. Aberle, "Injection level dependence of the defect-related carrier lifetime in light-degraded boron-doped Czochralski silicon," *Applied Physics Letters*, vol. 73, no. 15, pp. 2167-2169, Oct 1998.

F. Schuurmans, "Surface Passivation of Silicon by PECVD Silicon Nitride," *Ph.D. Thesis*, 1998.

M.J. Stocks, "High Efficiency Multicrystalline Silicon Solar Cells," *Ph.D. Thesis*, Australian National University, 1998.

## 1997

P.P. Altermatt, J. Schmidt, G. Heiser, et al., "Assessment and parameterisation of Coulomb-enhanced Auger recombination coefficients in lowly injected crystalline silicon," *Journal of Applied Physics*, vol. 82, no. 10, pp. 4938-4944, Nov 1997.

A. Cuevas, M. Stocks, S. Armand, M. Stuckings, A. Blakers, and F. Ferrazza, "High minority carrier lifetime in phosphorus-gettered multicrystalline silicon," *Applied Physics Letters*, vol. 70, no. 8, pp. 1017-1019, 1997.

A.S. Cuevas, and R.A. Sinton, "Prediction of the open-circuit voltage of solar cells from the steady-state photoconductance," *Progress in Photovoltaics: Research and Applications*, vol. 5, no. 2, pp. 79-90, Mar.-Apr. 1997.

Tutorial-style paper concerning applications of QSSPC measurements to solar cells.

D.K. Schroder, "Carrier Lifetimes in Silicon," *IEEE Transactions on Electron Devices*, vol. 44, no. 1, pp. 160-170, 1997.

F. M. Schuurmans, A. Schonecker, A. R. Burgers, and W. C. Sinke, "Simplified evaluation method for light-biased effective lifetime measurements," *Applied Physics Letters*, vol. 71, no. 13, pp. 1795-1797, Sep. 1997.


M. Stocks, A. Cuevas, and A. Blakers, "Minority Carrier Lifetimes of Multicrystalline Silicon During Solar Cell Processing," *14th European Photovoltaic Solar Energy Conference*, pp. 770-773, 1997.

M. Stocks, A. Cuevas, and A. Blakers, "Process Monitoring of Multicrystalline Silicon solar Cells with Quasi-Steady-State Photoconductance Measurements," *IEEE Photovoltaic Specialist Conference*, pp. 123-126, 1997.


## 1996

A.G. Aberle, J. Schmidt, and R. Brendel, "On the data analysis of light-biased photoconductance decay measurements," *Journal of Applied Physics*, vol. 79, no. 3, pp. 1491-1496, 1996.

A. Cuevas, P.A. Basore, G. Giroult-Matlakowski, et al., "Surface recombination velocity of highly doped n-type silicon," *Journal of Applied Physics*, vol. 80, no. 6, pp. 3370-3375, Sep 1996.

A. Cuevas, R.A. Sinton, and M. Stuckings, "Determination of Recombination Parameters in Semiconductors from Photovoltage Measurements," *Proceedings of 1996 Conference on Optoelectronic and Microelectronic Materials and Devices*, pp. 16-19, 1996. 

R.A. Sinton, and A. Cuevas, "Contactless determination of current-voltage characteristics and minority-carrier lifetimes in semiconductors from quasi-steady-state photoconductance data," *Applied Physics Letters*, vol. 69, no. 17, pp. 2510-12, Oct 1996.

R.A. Sinton, A. Cuevas, and M. Stuckings, "Quasi-Steady-State Photoconductance, A New Method for Solar Cell Material and Device Characterization," *Proc of the 25th IEEE Photovoltaic Specialists Conference*, pp. 457-460, 1996. 

First major reference for QSSPC photoconductance method.

E. Yablonovitch, and T. Gmitter, "Auger recombination in silicon at low carrier densities," *Applied Physics Letters*, vol. 49, no. 10, pp. 587-9, Sep 1996.

## 1994

A. Cuevas, G. Basore, P. Giroult-Matlakowski, C. DuBois, and R.R. King, "Extraction of the Surface Recombination Velocity of Passivated Phosphorus-doped Silicon Emitters," *1st World Conference on Photovoltaic Solar Energy Conversion*, pp. 1446-1449, 1994.

A. Sproul, "Dimensionless solution of the equation describing the effect of surface recombination on carrier decay in semiconductors," *Journal of Applied Physics*, vol. 76, no. 5, pp. 3852-2854, 1994.

## 1993

A.G. Aberle, S.R. Wenham, and M.A. Green, "A New Method for the Accurate Measurements of the Lumped Series Resistance of Solar Cells," *Conference Record of the Twenty Third IEEE Photovoltaic Specialists Conference*, pp. 133-138, 1993.

Describes using series resistance measurements on modern high-efficiency devices and an explanation of two-dimensional effects.

S.K. Pang, and A. Rohatgi, "A new methodology for separating Shockley-Read-Hall


lifetime and Auger recombination coefficients from the photoconductivity decay technique," *Journal of Applied Physics*, vol. 74, no. 9, pp. 5554-60, Nov 1993.

## 1990

R.R. King, P.E. Gruenbaum, R.A. Sinton, and R.M. Swanson, "Passivated emitters in silicon solar cells," *Conference Record of the Twenty First IEEE Photovoltaic Specialists Conference - 1990 (Cat. No.90CH2838-1)*, vol. 1, pp. 227-32, 1990.

R.R. King, R.A. Sinton, and R.M. Swanson, "Studies of diffused phosphorus emitters: saturation current, surface recombination velocity, and quantum efficiency," *IEEE Transactions on Electron Devices*, vol. 37, no. 2, pp. 365-71, Feb 1990.

## Archives


M. Wolf, and H. Rauschenbach, "Series Resistance Effects on Solar Cell Measurements," *Advanced Energy Conversion*, vol. 3, pp. 455-479, 1963. 

The classic reference for using illumination-Voc curves for the analysis of solar cells.

D.E. Kane, and R.M. Swanson, "Measurement of the Emitter Saturation Current by a Contactless Photoconductivity Decay Method," *Proc of the 18th IEEE Photovoltaic Specialists Conference*, pp. 578-583, 1985.

Classic reference for a method to separate bulk recombination from dopant diffusion recombination on lightly-doped wafers using the injection-level dependence of lifetime.

R.R. King, R.A. Sinton, R.M. Swanson, and T.F. Cizek, "Low surface recombination velocities on doped silicon and their implications for point contact solar cells," *Conference Record of the Nineteenth IEEE Photovoltaic Specialists Conference - 1987 (Cat. No.87CH2400-0)*, pp. 1168-73, 1987.

R.A. Sinton, and R.M. Swanson, "Recombination in highly injected silicon (solar cells)," *IEEE Trans. Electron Devices (USA)*, vol. 34, no. 6, pp. 1380-9, Jun 1987. 

Determination of the ambipolar recombination coefficient at  $1.66e-30 \text{ cm}^6/\text{s}$   $\pm$  or-15%.

P.E. Gruenbaum, R.A. Sinton, and R.M. Swanson, "Stability problems in point contact solar cells," *Conference Record of the Twentieth IEEE Photovoltaic Specialists Conference - 1988 (Cat. No.88CH2527-0)*, vol. 1, pp. 423-8, 1988.

R.R. King, R.A. Sinton, and R.M. Swanson, "Front and back surface fields for point-contact solar cells," *Conference Record of the Twentieth IEEE Photovoltaic Specialists Conference - 1988 (Cat. No.88CH2527-0)*, vol. 1, pp. 538-44, 1988.

R.R. King, R.A. Sinton, and R.M. Swanson, "Doped surfaces in one sun, point-contact solar cells," *Applied Physics Letters*, vol. 54, no. 15, pp. 1460-2, Apr 1989.