E-MRS Spring Meeting 2001

June 5 - 8, 2001

SYMPOSIUM E

Crystalline Silicon for Solar Cells

Symposium Organizers:

Martin Kittler, IHP GmbH, Frankfurt (Oder), Germany

Wolfgang Koch, Bayer AG, Krefeld, Germany

Santo Martinuzzi, University of Marseille, France

Timothy Bruton, BP Solar, Surrburry-on-Thames, U.K.

Symposium Support :

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Papers will be published in Solar Energy Material & Solar Cells

E-MRS 2001 SPRING MEETING

SYMPOSIUM E

Tuesday, June 5, 2001 **Afternoon**
Mardi 5 juin 2001 Après-midi

OPENING REMARKS

13:50 M. Kittler, IHP Frankfurt (Oder)

Session I: General and Feedstock
Session Chair: S. Martinuzzi, University of Marseille, France

E-I.1 14:00 -Invited- GENERAL TRENDS ABOUT PHOTOVOLTAICS BASED ON CRYSTALLINE SILICON, **T. Bruton**, BP Solar, Surrburry-on-Thames, UK

E-I.2 14:30 -Invited- SOLAR SILICON FEEDSTOCK SUPPLY - TODAY AND TOMORROW, **P. Woditsch**, Deutsche Solar GmbH, Krefeld, Germany

E-I.3 15:00 REFINING OF METALLURGICAL GRADE SILICON BY INDUCTIVE PLASMA, C. Alemany(a), C. Trassy(b), B. Pateyron(c), K-I Li(b), Y. Delannoy(b), (a)LPCI, bat 401, INSA, 69621 Villeurbanne, France, (b)EPM, ENSHMG, BP 95, 38402 Saint Martin d'Hères, France, (c)SPCTS, Faculté des sciences, 123 av. A. Thomas, 87060 Limoges, France

E-I.4 15:20 SOLAR CELLS FROM MULTI-CRYSTALLINE UMG AND PLASMA-PURIFIED UMG SILICON SUBSTRATES, S. De Wolf, J. Szlufcik, IMEC vzw, Kapeldreef 75, 3001 Leuven, Belgium, Y. Delannoy, EPM Madylam, ENSHMG, BP 95, 38402 St. Martin d'Hères, France and I. Périchaud, UMR TECSEN, University of Marseille, France

E-I.5 15:40 NUMERICAL SIMULATIONS FOR SILICON CRYSTALLIZATION PROCESSES, I. Steinbach, M. Apel, T. Rettelbach, and D. Franke, ACCESS e.V., Aachen, Germany

16:00 **BREAK**

Session II: Casting and Crystallization
Session Chair: W. Koch, Bayer AG, Krefeld, Germany

E-II.1 16:20 -Invited- LARGE SIZE mc-Si INGOTS, **F. Ferrazza**, Eurosolare S.p.A., Via A. D'Andrea 6, 00048 Nettuno, Italy

E-II.2 16:50 SILICON INGOT CASTING: PROCESS DEVELOPMENT BY NUMERICAL SIMULATIONS, D. Franke and Th. Rettelbach, ACCESS e.V., Aachen, Germany

E-II.3 17:10 MELT GROWTH OF MULTICRYSTALLINE SiGe WITH LARGE COMPOSITIONAL DISTRIBUTION FOR NEW SOLAR CELL APPLICATIONS, K. Nakajima, N. Usami, K. Fujiwara, Y. Murakami, T. Ujihara, G. Sazaki and T. Shishido, Institute for Materials Research, Tohoku University, Katahira 2-1-1, Aoba-ku, Sendai 980-8577, Japan

E-II.4 17:30 MULTICRYSTALLINE SILICON PREPARED BY ELECTROMAGNETIC CONTINUOUS PULLING. RECENT RESULTS AND COMPARISON TO DIRECTIONAL SOLIDIFICATION MATERIAL, I. Périchaud, S. Martinuzzi, UMR TECSEN University of Marseille, France, Francis Durand, INP Grenoble and CNRS, France

POSTER SESSION – Part A

Part A: Feedstock - Silicon Crystals, Thin Films and Ribbons – Novelties

E/P-A1 PLASMA REFINING PROCESS TO PROVIDE SOLAR GRADE SILICON, Y. Delannoy(a), C. Alemany(b), K-I Li(a), P. Proulx(c), C. Trassy(a), (a)EPM, ENSHMG, BP 95, 38402 Saint Martin d'Hères, France, (b)LPCI, B,t 401, INSA, 69621 Villeurbanne, France, (c)CRTP, Faculté de génie, Sherbrooke (Québec) J1K 2R1, Canada

E/P-A2 GLOBAL THERMAL MODELING OF THE CZOCHRALSKI PROCESS FOR THE GROWTH OF TRI-CRYSTALLINE SILICON CRYSTALS FOR PHOTO-VOLTAIC APPLICATIONS, M. Krause(a), J.Friedrich(a), G. Müller(a), A. Endrös(b), A. Lerchenberger(b), (a)Crystal Growth Laboratory, Fraunhofer Institute for Integrated Circuits, (b)Siemens Solar

E/P-A3 EFFECT OF HEAT TREATMENT ON CARBON IN MULTICRYSTALLINE SILICON, Deren Yang(a,b), H.J. Moeller(b), (a)State Key Lab of Silicon Material, Zhejiang University, 310027 Hangzhou, People's Republic of China, (b)Institute for Experimental Physics, Technical University of Freiberg, 09596 Freiberg, Germany

E/P-A4 COMPARISON BETWEEN SiNx:H AND HYDROGEN PASSIVATION OF ELECTROMAGNETICALLY CASTED MULTICRYSTALLINE SILICON MATERIAL, E. Fourmond, M. Lemiti, A. Laugier, INSA Lyon, LPM, Villeurbanne, France, R. Bilyalov, J. Poortmans, IMEC Leuven, Belgium

E/P-A5 EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF A NEW POTENTIAL BARRIER DUE TO SHARP a-Si/c-Si HETEROINTERFACES BURIED IN THE SOLAR CELL EMITTER, M. Ley, Z.T. Kuznicki, Laboratoire PHASE, CNRS UPR 292, 23 rue du Loess, 67037 Strasbourg cedex 2, France

E/P-A6 NEW NEAR IR EFFECT DUE TO AN ACTIVE AMORPHISED SUBSTRUCTURE INSERTED IN A c-Si SOLAR CELL EMITTER, Z.T. Kuznicki, M. Ley, Laboratoire de PHASE, CNRS UPR 292, 23 rue du Loess, 67037 Strasbourg cedex 2, France

E/P-A7 OPTICAL IMPROVED STRUCTURE OF POLYCRISTALLINE SILICON BASED THIN FILM SOLAR CELL, E. Budianu, M. Purica, E. Manea, National Institute for Research & Development in Microtechnologies, PO Box 38-160, 72225 Bucharest, Romania

E/P-A8 STUDY OF THE SOLID PHASE CRYSTALLIZATION BEHAVIOR OF AMORPHOUS SPUTTERED SILICON BY X RAY DIFFRACTION AND ELECTRICAL MEASUREMENTS, G. Farhi, M. Aoucher et T. Mohammed-Brahim*, Laboratoire de Physique des Matériaux, Faculté des Sciences Physiques, USTHB, BP 32 El Alia 16111 BabEzzouar, Alger, Algerie, *GMV, Université de Rennes I, Campus de Beaulieu, Bat.11B, 35042 Rennes Cedex, France

E/P-A9 THIN EPITAXIAL SOLAR CELLS ON METALLURGICAL POLYCRYSTALLINE SILICON SUBSTRATE, S. Zainabidinov, R. Aliev and I. Karimov, Department of Physics, Andijan State University, University street 129, 710000 Andijan, Uzbekistan

Wednesday, June 6, 2001 **Afternoon**
Mercredi 6 juin 2001 Après-midi

Joint Session of Symposium E and Symposium P

Session III: Crystalline Silicon Thin Films on Substrate
Session Chair: W. Sinke, ECN Petten, The Netherlands

E-III.1 14:00 -Invited- THIN CRYSTALLINE SILICON SOLAR CELLS – STATUS AND PERSPECTIVES, **G. Willeke**, Fraunhofer ISE, Oltmannsstr. 5, 79100 Freiburg, Germany

E-III.2 14:30 SIMULATION OF THE CRYSTALLISATION OF SILICON RIBBONS ON SUBSTRATE, M. Apel, D. Franke, I. Steinbach, ACCESS e.V., Intzestrasse 5, 52072 Aachen, Germany

E-III.3 14:45 SILICON SHEET FROM SILANE: FIRST RESULTS, C. Rodrigues Pinto, R.M. Gamboa, J.C. Henriques, J.M. Serra, J. Maia Alves and A.M. Vallera, Universidade de Lisboa, Departamento de Física /CCMM, 1749-016 Lisboa, Portugal

E-III.4 15:00 -Invited- FUTURE CRYSTALLINE Si THIN FILMS ON FOREIGN SUBSTRATES, **R.B. Bergmann** and J.H. Werner, Institut für Physikalische Elektronik, Universität Stuttgart, Germany

E-III.5 15:30 CRYSTALLINE SILICON THIN FILMS WITH POROUS Si BACKSIDE REFLECTOR, R. Bilyalov, J. Poortmans, O. Richard, H. Bender, M.Kummer*, H. von Konel*, IMEC, Kapeldreef 75, B-3001 Leuven, Belgium, *Laborator for Solid State Physics, ETH-Zurich, CH-8093 Zürich, Switzerland

E-III.6 15:45 MICROWAVE MOBILITY IN PROFILED POLY-Si THIN FILMS DEPOSITED ON GLASS BY HOT WIRE CVD, P.A.T.T. van Veenendaal(a) T.J. Savenije(b) J.K. Rath(a) and R.E.I. Schropp(a), (a)Debye Institute, Physics of Devices, Utrecht University, P.O. Box 80.000, 3508 TA Utrecht, The Netherlands; (b)Radiation Chemistry Department, IRI, Delft University of Technology, The Netherlands.

Session V: Crystalline Silicon Thin Films on Substrate II
Session Chair: A. Slaoui, PHASE Strasbourg, France

P-III.7 16:30 -invited- MICROCRYSTALINE SILICON AND "MICROMORPH" TANDEM SOLAR CELLS, Arvind Shah, J. Meier, E. Vallat-Sauvain, U. Kroll, N. Wyrsch and K. Guillet, Institute for Microtechnology, (IMT), University of Neuchâtel, A.-L. Breguet 2, 2000

P-III.8 17:00 SPECTRAL PHOTORESPONSES AND ELECTRONIC PROPERTIES OF POLYMORPHOUS SILICON THIN FILMS, J.P. Kleider, M. Gauthier, C. Longeaud, D. Roy, Laboratoire de Génie Electrique de Paris (UMR 8507 CNRS), Supélec, 11 rue Joliot-Curie, Plateau de Moulon, 91192 Gif-sur-Yvette Cedex, France

P-III.9 17:15 EFFECT OF SMALL CRYSTAL SIZE AND SURFACE TEMPERATURE ON THE RAMAN SPECTRA OF AMORPHOUS AND NANOSTRUCTURED Si THIN FILMS DEPOSITED BY RADIOFREQUENCY PLASMAS, S. Huet, G. Viera, L. Boufendi, Université d'Orléans, France

POSTER SESSION – Part B

Part B Cell Processing – Gettering and Passivation

E/P-B1 DOUBLE POROUS SILICON LAYER ON MULTICRYSTALLINE Si FOR PHOTOVOLTAIC APPLICATION, M. Lipinski, Z.Swiatek, E. Beltowska, R. Ciach, Institute of Metallurgy and Materials Science, Polish Academy of Sciences, 25 Reymonta Str., 30-059 Cracow, Poland

E/P-B2 MICROWAVE PLASMA PROCESSING FOR THIN-FILM Si SOLAR CELL, V. Gazuz, K. Feldrapp, R. Auer, R. Brendel, and M. Schulz, Bavarian Center for Applied Energy Research (ZAE Bayern), Am Weichselgarten 7, 91058 Erlangen, Germany

E/P-B3 N-P JUNCTION FORMATION IN P-TYPE mc-Si BY HYDROGEN PLASMA IMMERSION, D. Barakel, UMR TECSEN, University of Marseille, France, A. Ulyashin, Fern University, Germany, I. Périchaud and S. Martinuzzi, UMR TECSEN, University of Marseille, France

E/P-B4 HYDROGENATION OF SILICON BY THERMAL PLASMA TORCH, F. Bourg, B. Benmansour, D. Morvan, J. Amouroux, S. Pellerin(a) and J. Chapelle(a), LGPPTS - ENSCP, 11 rue Pierre et Marie Curie, 75005 Paris, France, (a)LASEP, Centre Universitaire de Bourges, BP 4043, 18028 Bourges Cedex, France

E/P-B5 ALUMINIUM BSF PASSIVATION IN SILICON SOLAR CELLS, A. Kaminski, B. Vandelle, A. Fave, J.P. Boyeaux, A. Laugier, Laboratoire de Physique de la Matière, UMR 5511, INSA de Lyon, Bâtiment 502, 20 av. A. Einstein, 69621 Villeurbanne Cedex, France, Le Quan Nam, R. Monna, D. Sarti, Photowatt Int. S.A., Z.I. Champfleuri, 33 rue Saint Honoré, 38300 Bourgoin-Jaillieu, France

E/P-B6 COMPARAISON OF PHOSPHORUS GETTERING FOR DIFFERENT MULTICRYSTALLINE SILICON, J. Boudaden(a,b), R. Monna(c), M. Loghmarti(b), D. Ballutaud(d), J.C. Muller(a), (a)Laboratoire PHASE, 23 rue du Loess, CNRS, Strasbourg, France, (b)Laboratoire de Physique des Matériaux, Rue Ibn Battouta, Faculté des Sciences, Rabat, Maroc, (c)Photowatt International S.A., 33 rue St-Honoré, 38300 Bourgoin-Jallieu, France, (d)Laboratoire de Physique des Solides et de Cristallogénèse, CNRS, 1 Place Aristide Briand, 92195 Meudon Cedex, France

E/P-B7 IRRADIATION EFFECTS ON POLYCRYSTALLINE SILICON, by V. Borjanovic(a), I. Kovacevic(b), H. Zorc(b), and B. Pivac(b), (a)Faculty for Electrical Engineering and Computing, Unska 3, 10000 Zagreb, Croatia, (b)Rudjer Boskovic Institute, P.O.B. 1016, 10000 Zagreb, Croatia

E/P-B8 ION BEAM AND LASER SOLID-PHASE MODIFICATIONS OF MONOCRYSTALLINE SILICON SOLAR CELL EMITTERS, Z. Swiatek(a), E. Beltowska(a), A. Pokhmurska(b), A.Yu. Bonchyk(b), Z.T. Kuznicki(c), (a)Institute of Metallurgy and Materials Science, Polish Academy of Sciences, 25 Reymonta St., 30-059 Cracow, Poland, (b)Pidstryhach Institute of Applied Problems of Mechanics and Mathematics, National Academy of Science of Ukraine, 3b Naukova St., 29060 Lviv, Ukraine, (c)CNRS, Laboratoire PHASE (UPR 292), BP 20, 23 rue du Loess, 67037 Strasbourg Cedex 2, France

E/P-B9 POROUS SILICON LAYER FORMATION ON ION IMPLANTED SUBSTRATES, Z. Swiatek(a), E. Beltowska(a), A. Pokhmurska(b), A.Yu. Bonchyk(b), M. Lipinski(a), (a)Institute of Metallurgy and Materials Science, Polish Academy of Sciences, 25 Reymonta Str., 30-059 Cracow, Poland, (b)Pidstryhach Institute of Applied Problemws of Mechanics and Matyhematics, National Academy of Science of Ukraine, 3b Naukova Str., 29060 Lviv, Ukraine

E/P-B10 SURFACE PHOTOVOLTAGE ANALYSES OF CRYSTALLINE SILICON FOR PHOTOVOLTAIC APPLICATIONS, A. Castaldini, D. Cavalcoli, A. Cavallini, M. Rossi, INFM and Physics Department, viale Berti Pichat 6/2, 40127 Bologna, Italy

E/P-B11 COST-EFFECTIVE METHODS OF TEXTURING FOR SILICON SOLAR CELLS, V. Yerokhov, A. Mylyanych, I. Semochko, Semiconductor Electronic Department, National University "Lviv Polytechnic", P.O. Box 1050, 79045 Lviv, Ukraine and M. Lipinski, P. Panek PAN IMIM, Krakow 30-059, Reymonta Str. 25, Poland

Thursday, June 7, 2001 — Morning
Jeudi 7 juin 2001 — Matin

Session IV: Crystalline Silicon
Session Chair: D. Sarti, Photowatt S.A., Bourgoin-Jailleu, France

E-IV.1 08:30 -Invited- MONO- AND TRI-CRYSTALLINE Si FOR PV APPLICATION, **A.L. Endrös**, Siemens Solar GmbH, Otto-Hahn-Ring 6, 81739 Munich, Germany

E-IV.2 09:00 ELECTROMAGNETIC CONTINUOUS PULLING PROCESS COMPARED TO CURRENT CASTING PROCESSES WITH RESPECT TO SOLIDIFICATION CHARACTERISTICS, F. Durand, EPM Madylam, 1340 rue de la Piscine, 38402 St. Martin d'Hères, France

E-IV.3 09:20 OXYGEN IN CZOCHRALSKI SILICON USED FOR SOLAR CELLS, Deren Yang, Lirong Wang, Dongsheng Li, Xiangyang Ma, Duanlin Que, State Key Lab of Silicon Material, Zhejiang University, Hangzhou 310027, P. R. China

E-IV.4 09:40 ELIMINATION OF LIGHT-INDUCED DEGRADATION IN P-TYPE CZOCHRALSKI SILICON BY ALUMINIUM, GALLIUM OR INDIUM DOPING, A. Metz and R. Hezel, Institut für Solarenergieforschung Hameln/Emmerthal (ISFH), Am Ohrberg 1, 31860 Emmerthal, Germany

10:00 **BREAK**

Session V: Ribbons and Foils
Session Chair: K. Roy, Representative of the National German Solar Materials Project 'KoSi'

E-V.1 10:20 -Invited- SILICON RIBBONS AND FOILS – STATE OF THE ART, **J.P. Kalejs**, ASE Americas, 4 Suburban Park Drive, Billerica MA 01821, USA

E-V.2 10:50 COMPARING IMPROVED STATE-OF-THE-ART TO FORMER EFG Si-RIBBONS WITH RESPECT TO SOLAR CELL PROCESSING AND HYDROGEN PASSIVATION, P. Geiger, G. Hahn, P. Fath, E. Bucher, Universität Konstanz, Fachbereich Physik, Fach X916, 78457 Konstanz, Germany

E-V.3 11:10 SILICON SHEET SHAPING USING ELECTROMAGNETIC FORCE, K. Kaneko, EMIX, 13 rue de la Condamine, 38610 Gières, France, formerly EPM Madylam, 1340 rue de la Piscine, 38402 St. Martin d'Hères, France

E-V.4 11:30 COMPARATIVE STUDIES OF EFG RIBBON POLY-Si GROWN BY DIFFERENT PROCEDURES, B. Pivac(a), V. Borjanovic(b), I. Kovacevic(a), E. Katz(c), (a)Faculty of electrical engineering and computing, University of Zagreb, Croatia, and (b)Rudjer Boskovic Institute, P.O.Box 180, 10002 Zagreb, Croatia, (c)The National Solar Energy Center, The Jacob Blaustein Institute for Desert Research, The Ben-Gurion University of the Negev, Sede Boker Campus, 84990 Israel

E-V.5 11:50 SILICON TUBES BY CLOSED MOLTEN ZONE: A CHARACTERISATION STUDY, R.M. Gamboa, M.C. Brito, J.C. Henriques, J.M. Serra, J. Maia Alves and A.M. Vallera, Universidade de Lisboa, Dep. de Física/CCMM, 1749-016 Lisboa, Portugal

12:10 **BREAK**

Thursday, June 7, 2001 **Afternoon**
Jeudi 7 juin 2001 Après-midi

Session VI: Cell Processing
Session Chair: T. Bruton, BP Solar, Surrburry-on-Thames, U.K.

E-VI.1 13:50 -Invited- DEFECT PASSIVATION OF INDUSTRIAL MULTICRYSTALLINE SOLAR CELLS BASED ON PECVD SILICON NITRIDE, **J. Szlufcik**, F. Duerinckx, IMEC, Kapeldreef 75, 3001 Leuven, Belgium

E-VI.2 14:20 -Invited- SILICON FEEDSTOCK FOR THE MULTI-CRYSTALLINE PV INDUSTRY, **D. Sarti** and R. Einhaus, Photowatt International, 33, rue Saint Honoré, 38300 Bourgoin-Jallieu, France

E-VI.3 14:50 SIMULTANEOUS Si-BULK HYDROGEN PASSIVATION AND SURFACE ETCHING ASSISTED BY ECR-HYDROGEN PLASMA: APPLICATION TO SELECTIVE EMITTER FORMATION, L. Debarge, J. Boudaden, J.C. Muller, PHASE/CNRS, 23 rue du Loess, 67037 Strasbourg, France, D. Ballutaud, LPSB/CNRS, 1 place Aristide Briand, 92195 Meudon Cedex, France, R. Monna, PHOTOWATT Int, ZI Champfleuri, 38300 Bourgoin-Jallieu, France

E-VI.4 15:10 HYDROGEN PASSIVATION OF DEFECTS BY PLASMA ENHANC-ED CHEMICAL VAPOUR DEPOSITED SILICON NITRIDE ON THE FRONT AND REAR SUREFACE OF MULTICRYSTALLINE SILICON SOLAR CELLS, L. Mittelstädt, Axel Metz and R. Hezel, Institut für Solarenergieforschung Hameln/Emmerthal, Am Ohrberg 1, 31860 Emmerthal, Germany

E-VI.5 15:30 DEVELOPMENT OF RAPID THERMAL PROCESSING FOR INDUSTRIAL SOLAR CELL PROCESSING, J. Horzel, C. Allebè, J. Szlufcik, IMEC v.z.w., Kapeldreef 75, 3001 Leuven, Belgium

15:50 **BREAK**

Session VII: Defects and Diagnostics 1
Session Chair: W. Schröter, Universität Göttingen, Germany

E-VII.1 16:10 -Invited- DEFECT AND IMPURITY DIAGNOSTICS AND PROCESS MONITORING, **Wilhelm Warta**, Fraunhofer Institute for Solar Energy Systems, Freiburg, Germany

E-VII.2 16:40 -Invited- OXYGEN AND LATTICE DISTORTIONS IN MULTICRYSTALLINE SILICON, **H.J. Möller**, A. Lawerenz, M. Rinio, St. Riedel, Institute for Experimental Physics, TU Bergakademie Freiberg, Silbermannstr. 1, 09596 Freiberg, Germany, and Martina Werner, Max-Planck Institute for Microstructure Physics, Am Weinberg 2, 06120 Halle, Germany

E-VII.3 17:10 FAST LBIC IN-LINE CHARACTERIZATION FOR PROCESS QUALITY CONTROL IN THE PHOTOVOLTAIC INDUSTRY, M. Acciarri, S. Binetti, A. Racz, S. Pizzini, INFM and Department of Materials Science, Via Cozzi 53, 20126 Milano, Italy

E-VII.4 17:30 SURFACE ANALYSES OF POLYCRISTALLINE CZ Si WAFERS, A. Castaldini, D. Cavalcoli, A. Cavallini, M. Rossi, INFM and Physics Department, viale Berti Pichat 6/2, 40127 Bologna, Italy

E-VII.5 17:50 CLASSIFICATION OF SHUNTING MECHANISMS IN CRYSTALLINE SILICON SOLAR CELLS, M. Langenkamp, O. Breitenstein, Max Planck Institute of Microstructure Physics Halle, Weinberg 2, 06120 Halle, Germany

POSTER SESSION – Part C

Part C Defects and Diagnostics

E/P-C1 DEFECTS IN POLYCRYSTALLINE SILICON STUDIED BY IBICC, by V. Borjanovic(a), M. Jaksic(b), Z. Pastuovic(b), B. Pivac(b), (a)Faculty of electrical engineering and computing, University of Zagreb, Croatia, and (b)R. Boskovic Institute, P.O.Box 180, 10002 Zagreb, Croatia

E/P-C2 CHARACTERISATION OF STAIN ETCHED POROUS SILICON ANTIREFELECTION COATINGS BY ANODIC OXIDATION, R. Guerrero-Lemus and C. Hernandez-Rodrìgues, Universidad de La Laguna, Tenerife, Spain, F. Ben-Hander and J.M. Martinez-Duart, Departamento de Fisica Aplicada, C-XII, Universidad Autonoma de Madrid, 28049 Madrid, Spain

E/P-C3 LUMINESCENT PROPERTIES OF STAIN ETCHED POROUS SILICON ANTIREFLECTION COATINGS FOR SOLAR CELLS, F. Ben-Hander and J.M. Martinez-Duart., Departamento de Fisica Aplicada, C-XII, Universidad Autonoma de Madrid, 28049 Madrid, Spain, J.L.G. Fierro. Instituto de Catalisis y Petroleoquimica, CSIC, Universidad Autonoma de Madrid, 28049 Madrid, Spain, C. Hernandez-Rodriguez and R. Guerrero-Lemus, Departamento de Fisica Basica, Facultad de Fisica, Universidad de La Laguna, 38204 S/C de Tenerife, Spain

E/P-C4 IMPURITIES AND DEFECTS IN MULTICRYSTALLINE SILICON FOR SOLAR CELLS: LOW-TEMPERATURE PHOTOLUMINESCENCE INVESTIGATIONS, A.V. Mudryi, A.I. Patuk, I.A. Shakin, Institute of Solid State and Semiconductor Physics, Minsk, P. Brovki 17, 220072 Minsk, Belarus, A.G. Ulyashin, R. Job, W.R. Fahrner, University of Hagen (LGBE), P.O. Box 940, 58084 Hagen, Germany, A. Fedotov, A. Mazanik, N. Drozdov, Belarussian State University, F. Skaryna av. 4, 220050 Minsk, Belarus

E/P-C5 INHOMOGENITY AND TEXTURE IN POROUS SILICON LAYERS, Z. Swiatek(a), E. Beltowska(a), J. Bonarski(a), F. Krok(b), (a)Institute of Metallurgy and Materials Science, Polish Academy of Sciences, 25 Reymonta Str., 30-059 Cracow, Poland, (b)Regional Laboratory for Physicochemical Analyses and Structural Research, Jagiellonian University, 30-060 Krakow, 3 Ingardena Str., Poland

E/P-C6 ELECTRICAL ACTIVITY OF DEEP TRAPS IN P-TYPE Si, M. Kaniewska(a) and M. Lal(b), (a)Institute of Electron Technology, Al. Lotnikow 32/46, 02-668 Warsaw, Poland, (b)National Physical Laboratory, Council of Scientist and Industrial Research, Dr. K.S. Krishnan Road, New Delhi 110012, India

E/P-C7 CURRENT VOLTAGE CHARACTERISTICS ANALYSIS IN Si BASED SOLAR CELLS: TEMPERATURE EFFECT, R. Ajjel and H. Maaref, Laboratoire de Physique des Semiconducteurs et des Composants Electroniques, Faculté des Sciences, 5000 Monastir, Tunisia, A. Drighli and M. Zazoui, Laboratoire de Physique de la Matière Condensée, Faculté des Sciences et Techniques Université Mohammedia II, B.P. 146, Mohammedia, Morocco

E/P-C8 PEEM-A SPECTROMICROSCOPIC TOOL FOR mc-Si SURFACE EVALUATION, P. Hoffmann, R.P. Mikalo, D. Schmeißer, BTU Cottbus, Lehrstuhl Angewandte Physik II/Sensorik, Erich-Weinert-Str. 1, 03046 Cottbus, Germany

E/P-C9 THE SLOW ELECTRON SCATTERING BY Si-p SURFACE AS A METHOD OF STUDYING THE SURFACE STATES, V.M. Feyer(a), T.Yu. Popik(a), O.B. Shpenik(a), Yu.V. Popik(b), M.M. Evrevdy(a), (a)Institute of Electron Physics, Ukrainian National Academy of Science, Ukraine, (b)Uzhgorod National University, Pidhirna St. 46, Uzhgorod 88000, Ukraine

E/P-C10 THE SURFACE STATES IN CRISTALLINE SILICON, V.M. Feyer(a), T.Yu. Popik(a), O.B. Shpenik(a), Yu.V. Popik(b), A.M. Zavilopulo(a), A. Bylica(c), E.M. Sheregii(c), W. Maziarz(d), R. Ciach(d), (a)Institute of Electron Physics, Ukrainian National Academy of Science, Ukraine; (b)Uzhgorod National University, Ukraina; (c)Rzeszow Pedagogical University, Poland; (d)Institute of Metallurgy and Material Science of PAN, Poland

E/P-C11 SEM OBSERVATION, PHOTOCONDUCTIVITY INVESTIGATION AND I-V STUDY OF SI STRUCTURES WITH PATTERNED MORPHOLOGY FOR SOLAR IRRADIANCE DETECTION, T.Ya. Gorbach(a), P.S. Smertenko(a), S.V. Svechnikov(a), V.P. Bondarenko(b), R. Ciach(c) and M. Kuzma(d), (a)Institute of Semiconductor Physics, NASU, 45 Prospect Nauki, 03028 Kyiv, Ukraine, (b)Belarus State University of Informatics and Radioelectronics, 6 prospect P. Brovki, 220023 Minsk, Belarus, (c)Institute of Metallurgy and Material Science, Polish Academy of Sciences, 25 Reymonta, 30-059 Cracow, Poland and (d)Institute of Physics, Higher Pedagogical School, 16a Rejtana, 35-309 Rzeszów, Poland

E/P-C12 TWO DIMENSIONAL RESOLUTION OF MINORITY CARRIER DIFFUSION CONSTANTS IN DIFFERENT SILICON MATERIALS, D. Sontag, G. Hahn, P. Fath, E. Bucher, Universität Konstanz, Fachbereich Physik, Fach X916, 78457 Konstanz, Germany

E/P-C13 EXTRACTION OF SOLAR CELL PARAMETERS FROM THE EBIC SIMULATION, M. Derras(a,b), A. Kadoun(b), (a)Faculté de Génie Electronique, USTHB, BP 32, El Alia, 16111 Bab Ezzouar, Alger, Algeria, (b)Laboratoire de Microscopie Electronique, Université Djillali Liabbès de Sidi Bel Abbès, BP 89, Larbi Ben M'Hidi, 22000 Sidi Bel Abbès, Algeria

Friday, June 8, 2001 — Morning
Vendredi 8 juin 2001 — Matin

Session VIII: Defects and Diagnostics 2
Session Chair: M. Kittler, IHP Frankfurt (Oder), Germany

E-VIII.1 08:30 -Invited- DEFECT RECOGNITION AND IMPURITY DETECTION TECHNIQUES IN CRYSTALLINE Si FOR SOLAR CELLS, **E.R. Weber**, University of California at Berkeley, CA, USA

E-VIII.2 09:00 CURRENT COLLECTING CHANNELS IN RGS SILICON SOLAR CELLS – ARE THEY USEFUL?, G. Hahn, D. Sontag, Universität Konstanz, Fachbereich Physik, Fach X916, 78457 Konstanz, Germany and C. Haessler, Bayer AG, Rheinuferstr. 7-9, 47829 Krefeld, Germany

E-VIII.3 09:20 ROOM TEMPERATURE LUMINESCENCE AND EBIC RECOMBINATION BEHAVIOUR OF CRYSTAL DEFECTS IN MULTICRYSTALLINE SILICON, M. Kittler, W. Seifert, T. Arguirov, Joint Lab IHP and BTU, Im Technologiepark 25, 15236 Frankfurt (Oder), Germany and I. Tarasov, S. Ostapenko, University of South Florida, Tampa Fl 33620, USA

E-VIII.4 09:40 RESISTIVITY TOPOGRAPHY: A GRAIN BOUNDARY CHARACTERISATION METHOD, M. Barranco Díaz*, W. Koch, C. Häßler and H-G. Bräutigam, Zentrale Forschung BAYER AG Rheinuferstraße 7-9, 47829 Krefeld, Germany
(*) EU-Marie Curie Post-Doctorate

10:00 **BREAK**

Session IX: Gettering and Passivation
Session Chair: E.R. Weber, University of California at Berkeley, USA

E-IX.1 10:20 -Invited- MECHANISMS AND SIMULATIONS OF TRANSITION-METAL GETTERING IN SILICON, **W. Schröter** and V.V. Kveder, IV. Physikalisches Institut der Universität Göttingen, Bunsenstr. 13-15, 37073 Göttingen, Germany

E-IX.2 10:50 -Invited- GETTERING OF IMPURITIES lN SOLAR SILICON, **I. Périchaud**, UMR TECSEN 6221 – IDIS, Case 231, Fac. des Sciences et Techniques de Marseille - St Jérôme, 13397 Marseille cedex 20, France

E-IX.3 11:20 A SIMPLE PASSIVATION TECHNIQUE FOR THE EDGE AREA OF SILICON SOLAR CELLS IMPROVES THE EFFICIENCY, M. Hejjo Al-Rifai, J. Carstensen and H. Föll, Faculty of Engineering, Christian-Albrechts University of Kiel, Kaiserstr. 2, 24143 Kiel, Germany

E-IX.4 11:40 PASSIVATION OF SILICON BY SILICON NITRIDE FILMS, M. Kunst, O. Abdallah and F.Wünsch, HMI, Glienickerstr. 100, 14109 Berlin, Germany

E-IX.5 12:00 SOLAR CELLS PREPARED ON MULTICRYSTALLINE SILICON SUBJECTED TO NEW GETTERING AND PASSIVATION TREATMENTS, V.G. Litovchenko, N.I. Klyui, A.A. Evtukh, A.A. Efremov, V.G. Popov, Institute of Semiconductor Physics, 45 prospect Nauki, 252028, Kiev, Ukraine; Ch. Hässler, W. Koch, Bayer AG, Central Research Physics, PO 11 11 07, 47812 Krefeld, Germany

12:20 **LUNCH**

Friday, June 8, 2001 **Afternoon**
Vendredi 8 juin 2001 Après-midi

Session X: Novelties
Session Chair: G. Willeke, FhG, ISE, Freiburg, Germany

E-X.1 13:20 A NOVEL MULTICRYSTALLINE Si SOLAR CELL USING GRAIN BOUNDARY ETCHING TREATMENT AND TRANSPARENT CONDUCTING OXIDE, D. G. Lim, I. Lee, W.-J. Lee, and J. Yi, School of Electrical and Computer Engineering, Sungkyunkwan University, Korea

E-X.2 13:40 THE INFLUENCE OF THE COMPOSITION OF Si-GE MIXED CRYSTALS ON THERMAL DIFFUSIVITY - PHOTOACOUSTIC APPROACH A. Patrin(a), N.V.Abrosimov(b), M.Malinski(a), L.Bychto(a), (a)Technical University of Koszalin, Poland, (b)Institute of Crystal Growth Berlin, Germany

E-X.3 14:20 ELECTRICAL ACTIVITY OF GRAIN BOUNDARIES IN POLYCRYSTALLINE AND DIRECTLY-BONDED SILICON AND ITS MODIFICATION BY HYDROGEN PLASMA TREATMENT, A. Fedotov, A. Mazanik, Belarusian State University, F. Skaryna av. 4, 220050 Minsk, Belarus and A. Ulyashin, University of Hagen, LGBE, Haldenener Str. 182, P.O. Box 940, 58084 Hagen, Germany

E-X.4 14:20 SILICON SOLAR CELLS WITH ANTIREFLECTION DIAMOND-LIKE CARBON AND SILICON CARBIDE FILMS, V.G. Litovchenko, N.I. Klyui, A.G. Rozhin, V.N. Dikusha; Institute of Semiconductor Physics of the National Academy of Sciences of Ukraine, Prospect Nauki 45, 03028 Kiev, Ukraine; M. Kittler, W. Seifert, IHP GmbH, Im Technologiepark 25, 15236 Frankfurt (Oder), Germany

E-X.5 14:40 -Invited- DEVELOPMENT OF A TECHNOLOGY OF SILICON PRODUCTION BY RECYCLING PHOSPHORUS INDUSTRY'S WASTES, **B.N. Mukashev**, M.F. Tamendarov, S.M. Kikkarin, A.A. Ustimenko, Institute of Physics and Technology, 480082 Almaty 82, Kazakstan

CLOSING REMARKS
15:00 S. Martinuzzi, University of Marseille