Amorphous and Polycrystalline Thin-Film Silicon Science and Technology–2011

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Amorphous and Polycrystalline Thin-Film Silicon Science and Technology–2011

Symposium held April 25–29, 2011, San Francisco, California, U.S.A.

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PREFACE

This volume includes sixty-eight papers presented in the 2011 MRS Spring Meeting Symposium A, "Amorphous and Polycrystalline Thin Film Silicon Science and Technology – 2011", which took place April 25-29, in San Francisco, California. The symposium covers the science and technology of thin-film silicon based materials and devices. The symposium traditionally started off on April 25 with an extremely well-attended full-day tutorial aimed at young researchers and people new to the field. The tutorial was lectured by Profs. Andrew Flewitt and Arokia Nathan. During the four days of fourteen oral sessions and two evenings of poster presentations, seventeen invited talks reviewed the recent progress and addressed the scientific and technical issues in the field. The oral and poster presentations reported new results in various areas, covering fundamental studies and technology advances.

Among various applications, solar cells for photovoltaic solar energy and thin-film transistors for flat-panel display have been the two major driving forces for research and development of thin-film silicon materials and devices. In the last few years, the thin-film silicon community has mainly focused on thin-film silicon solar cells to address the issues of efficiency, manufacturing capability and manufacturing cost. This year Symposium A held focused sessions on the topic of solar cell efficiency. Microcrystalline (μc-Si:H) or nanocrystalline silicon (nc-Si:H) offers the potential for improving the cell efficiencies. Dr. Friedhelm Finger (Forschungszentrum Jülich, Germany) reviewed the recent efficiency improvement in μc-Si:H solar cells with an emphasis on μc-SiC:H and μc-SiO:H doped layers and effective light management. Dr. Finger expected that over 14% efficiency with a-Si:H/μc-Si:H tandem solar cells will be attained soon. Prof. Miro Zeman (Delft University of Technology, The Netherlands) showed that 23% efficiency is achievable using a-SiC:H/a-SiGe:H/nc-Si:H triple-junction structure with advanced light trapping to enhance the photon harvesting of the sun light. Along this line, many new light trapping and light management approaches have been investigated, including plasmonic light scattering using metal and dielectric nano-particles and photonic structures. Theoretical and simulation studies show that the classical limit of $4n^2$ can be exceeded using advanced light trapping techniques. Dr. Takuya Matsui (AIST, Japan) presented their recent progress in developing μc-SiGe:H materials as low bandgap materials to absorb long wavelength light, which provides a new material for high efficiency solar cells. Significant progress in advancing the nc-Si:H technology for mass production has been made. Dr. Arindam Banerjee of United Solar Ovonic LLC (Michigan, USA) reported achieving initial 12% and stable 11.2% encapsulated module (400 cm^2) efficiencies with an a-Si:H/nc-Si:H/nc-Si:H triple-junction structure. The high module efficiencies are new world records for thin film silicon solar modules measured by the National Renewable Energy Laboratory. In addition, Symposium A had three sessions on thin film transistors, sensors and other novel devices reporting advances in these areas. To improve the device quality significant fundamental studies have been presented, especially advanced microscopic characterization (Dr. A. Fejfar, Academy of Sciences, Czech Republic) and simulations (Prof. D. Drabold, Ohio University, USA). The presentations covered the thin-film silicon materials ranging from amorphous to nano- and micro-structured materials, and polycrystalline thin films. The unique optical

properties of black silicon attracted significant attention for its potential application in solar cells as an effective light trapping material.

We had a very successful and enjoyable symposium. The number of presentations and attendees reflect the great need for development of thin-film silicon materials and devices. Unique and advanced results ensured the high quality of the symposium. As the organizers of Symposium A, we greatly acknowledge the invaluable contributions of the authors of oral and poster presentations, especially those who made written contributions to this volume

The symposium organizers thank all the people evolved in the Symposium before, during, and after the conference. The organizers greatly appreciate the program committee members of V. Chu (INESC, Portugal), A. Fejfar (Academy of Sciences of the Czech Republic, Czech Republic), F. Finger (Forschungszentrum Jülich, Germany), A. Flewitt (University of Cambridge, United Kingdom), T. Matsui (AIST, Japan), E.A. Schiff (Syracuse University, USA), P. Stradins (NREL, USA), J. Robertson (University of Cambridge, United Kingdom), and M. Zeman (Delft University of Technology, The Netherlands). They kindly reviewed all of the abstracts, which helped the organizers to prepare an interesting program. Special appreciation goes to all of the referees for their careful review of papers in the proceedings and valuable feedback given to the authors. We sincerely thank Mary Ann Woolf, who supervised and managed the abstract and manuscript reviewing process. Her experience and hard work allowed for smooth and timely production of this volume. The MRS staff provided friendly and professional support throughout the organization of the Symposium and Proceedings

On behalf of all the participants, we thank the generous financial support of our corporate sponsors: ITRI, NREL, ULVAC Inc., and United Solar Ovonic LLC.

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