Program

The 3rd Symposium on Solar and Sustainable Energies

Date	**2012. 05. 08 (Tue)**
Place	**A-115, GIST College**

Opening Remark

14:00~14:10	Welcome Address (**Jung Ho Sonu**, President, GIST)
14:10~14:20	Opening Address (**Seong Ju Park**, Director, RISE)

Session 1

14:20~15:05	Prof. **Alan J. Heeger**
●	: University of California Santa Barbara(USA)
15:05~15:30	Prof. **Ayodhya N. Tiwari** : Empa, Swiss Federal Laboratories
●	for Material Science and Technology(Switzerland)
15:30~15:50	Coffee Break

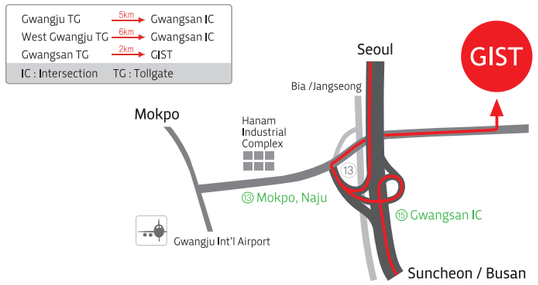
Session 2

15:50~16:15	Prof. **Marc T.M. Koper** : Leiden University(Netherlands)
16:15~16:40	Prof. **Guillermo C. Bazan**
●	: University of California Santa Barbara(USA)
16:40~17:05	Prof. **Steven A. Ringel** : Ohio State University(USA)
17:05~17:30	Prof. **Masatoshi Osawa** : Hokkaido University(Japan)
17:30~17:55	Prof. **Wladek Walukiewicz**
●	: Lawrence Berkeley National Laboratory(USA)

Research Institute for Solar and Sustainable Energies

Information

DIRECTION



TRANSPORTATION

By car

- From Seoul

(Honam express way, orange line in the next map):

- From Daegu

(88 express way, Blue line in the map): Gwangsan IC → Chomdan → GIST

By airplane

- To Gwangju airport
- Take a taxi to GIST.

(It will take 30 minutes and cost around 10,000 won)

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The 3rd Symposium on Solar and Sustainable Energies

Date ▸ 2012. 05. 08 (Tue)
14:00 ~ 18:00
Place ▸ A-115, GIST College

Organized by — Research Institute for Solar and Sustainable Energies

Supported by — Gwangju Institute of Science and Technology

HCAM Heeger Center for Advanced Materials

Ertl center for Electrochemistry & Catalysis

Invitation

The development and dissemination of renewable energy constitutes one of the major science and technology goals, and has played a pivotal role in pursuing Korea's national strategy of "Low Carbon Green Growth". In response to these national aspirations, the government-sponsored "Research Institute for Solar and Sustainable Energies (RISE)" has focused its research on the development of original technologies to ensure Korea's growth potential, in addition to the continued exploration of core applied technologies in order to lead future industrial developments. Through interdisciplinary collaborations with the Heeger Center for Advanced Materials and the Ertl Center for Electrochemistry & Catalysis at GIST, RISE has taken the lead in securing source technologies for renewable energy and in facilitating the commercialization of these technologies.

I am very pleased to invite you to the RISE Symposium. Indeed, it is our great pleasure to host leading scientists and engineers in this field, as we expect that participants in this symposium will have an invaluable opportunity to share their research and ideas in this fast-growing field of renewable energy.

I look forward to seeing you all at the RISE Symposium soon.

Professor **Seong-Ju Park**
Director of the Research Institute for Solar and Sustainable Energies (RISE)

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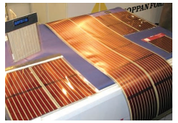
Session 1

Future Technologies Enabled by New Materials and Creative Ideas

∗ Alan J. Heeger 14:20~15:05

University of California, Santa Barbara, USA

- **OPV Science and Technology**



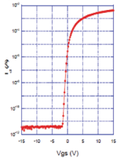
The device science and potential applications of OPV technology

- **Metal-oxide Semiconductors for High Performance Display Backplanes**

I will introduce **Novel Metal Oxide Based TFT Technology**
- ✓ High Mobility (~60 cm^2/Vs)
- ✓ >10^9 On/Off ratio
- ✓ S ~0.2 V/decade
- Innovative Device Design and Process

➡ Small TFT ➡ Large Aperture Ratio

ENABLES Large Scale OLED Displays



- **Liquid Biopsy™**

Cancer Diagnostic Blood Test

Changing the way we look at cancer diagnostics

High efficiency flexible CIGS solar cells and prospects of roll-to-roll manufacturability

∗ Ayodhya N. Tiwari 15:05~15:30

Head, Laboratory for Thin Films and Photovoltaics
Empa, Swiss Federal Laboratories for Materials Science and Technology, Switzerland

- CIGS thin film solar cells are attractive as high efficiency cells and modules can be grown on polymer and metal foils. Using a low temperature CIGS deposition process, compatible with polyimide film substrate, 18.7% and 17.7% efficiency flexible solar cells have been grown on polymer and steel foil, respectively. Such high efficiencies are achieved by overcoming different challenges in device processing and controlling parameters that contribute to optical and electronic losses. Control of micro-structural and chemical properties of constituent layers and their adjacent interfaces are vital in addition to impurities which could be detrimental or beneficial in CIGS.

Session 2

Electrocatalysis for solar fuels

∗ Marc T.M. Koper 15:50~16:15

Leiden Institute of Chemistry, Leiden University, The Netherland

- The efficient generation of fuels generated by solar energy, either directly or via the intermediate generation of electricity, requires catalysts for multi-electron transfer reactions. In this talk, I will describe our recent results on the mechanisms of the electrocatalytic reduction of carbon dioxide and carbon monoxide on copper electrodes, and on the mechanism of oxygen evolution on gold and other electrodes. Electrochemical measurements are complemented by in situ spectroscopy, online mass spectrometry and first-principles density functional theory calculations, to identify key intermediates and critical steps in the relevant reaction pathways.

Small Molecules for Solar Cell Fabrication: A New Type of Material Synthesis for Renewable Energy Research

∗ Guillermo C. Bazan 16:15~16:40

Center for Polymers and Organic Solids, University of California, Santa Barbara, USA

- High charge separation efficiency combined with the reduced fabrication costs associated with solution processing and the potential for implementation on flexible substrates make "plastic" solar cells a compelling option for the next generation of photovoltaic devices. The control the donor/acceptor blend morphology in bulk heterojunction materials as required for achieving high power conversion efficiency is therefore of primary concern. We showed that by incorporating a few volume percent of high boiling point solvent additive, the power conversion efficiency of photovoltaic cells (AM 1.5 conditions) is substantially increased, and this method of optimization is now the most widely used processing option for polymeric systems. Previous examination of the active layers has shown that the additives influence the size of the domains within the bulk heterojunction (BHJ) organization and can improve the order within the polymer domains.

III-V/Si Integrated Multijunction Solar Cells for High Efficiency Photovoltaics at Reduced Cost

∗ Steven A. Ringel 16:40~17:05

Neal Smith Endowed Chair and Professor of Electrical Engineering; Director, OSU Institute for Materials Research, USA

- Multijunction solar cells based on III-V compound semiconductors such as GaInP/GaAs define the state of the art in high efficiency photovoltaics. The partitioning of the solar spectrum by the vertical stacking of lattice matched solar cells with different bandgaps has allowed for improved utilization of the sun's spectrum coupled with excellent electronic transport properties needed for high carrier collection efficiency. These methods have enabled III-V multijunction solar cells to reach efficiencies in excess of 40% under concentrated sunlight. However, III-V solar cell technologies require yet higher efficiency to combat the high material and fabrication costs for conventional III-V photovoltaics. A path to achieve this that also directly addresses at the materials level is through the development of III-V/Si integrated multijunction solar cells. Epitaxy of III-V compound semiconductors on Si-based substrates with lattice constants between Si and Ge is of great interest for photovoltaic applications as it opens a pathway for achieving near ideal bandgap profiles for maximum solar energy conversion efficiency while simultaneously providing a low-cost and immediately scalable Si production platform for III-V cell technologies. Interestingly, the same range of lattice constants also enables access to direct gap III-Vs that can fill the "green gap" present in light emitting devices.

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Probing electrocatalytic reactions with surface-enhanced infrared absorption spectroscopy (SEIRAS)

∗ Masatoshi Osawa 17:05~17:30

Catalysis Research Center, Hokkaido University, Sapporo, Japan

- Conventional electrochemical techniques can provide a vast amount of kinetic and mechanistic information about electrocatalytic reactions. However, it is desirable to supplement this by surface analytical techniques for deeper insights into the reactions. Of the techniques available, surface-enhanced infrared absorption spectroscopy in the ATR mode (ATR-SEIRAS) is well suited for this task since it can provide valuable information on the identity as well as the reactivity of the species involved in the reaction. SEIRA is an effect similar to surface-enhanced Raman scattering (SERS) and infrared absorption of molecules in the very near vicinity of metal surfaces is significantly enhanced. Different from SERS, SEIRA occurs not only on coinage metals (Ag, Au, and Cu) but also on transition metals including Pt-group metals, which makes SEIRAS more valuable for investigating electrocatalytic reactions. In this talk, after brief introduction to the principle and experimental procedures, mechanistic studies on electrocatalytic oxidation of small organic molecules on Pt will be discussed.

New Materials for Solar Power Conversion Devices

∗ Wladek Walukiewicz 17:30~17:55

Senior Staff Scientist, Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, USA

- Recent progress in understanding of properties of complex semiconductor materials has opened a possibility of designing semiconductor materials with the electronic band structure optimized for specific device applications. This talk will present most recent research on a design and practical realization of semiconductors for solar power conversion devices, including high efficiency solar cells and photelectrochemical cells for solar water dissociation. The main part of the presentation will focus on highly mismatched alloys (HMAs) a new class of semiconductors whose electronic band structure is well described by the Band Anticrossing (BAC) model. I will present our work on applications of HMAs for intermediate band solar cells and initial efforts on synthesis of materials for solar water splitting. Finally I will discuss prospects of using group III-nitride alloys for full solar spectrum, multijuction solar cells.