

The Report of Participation in (Chemistry at The Frontiers of Biology and Physics Joint Symposium)

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1. Background

I participated in joint symposium “Chemistry at the Frontiers of Biology and Physics” between Osaka University and University of Strasbourg on 1-2 July 2010 at Institut de Science et d'Ingénierie Supramoléculaires, France. As the theme of the symposium showed, the topics covered by this symposium were very broad. It encompassed the role of Chemistry in the growing frontier researches on Biology and Physics. Chemistry as one of the fundamental branches of science covers wide areas of disciplines such as biochemistry, environmental chemistry, physical chemistry, and energy conversion. This interdisciplinary span of chemistry was represented in this symposium with broad topics presented by various experts in each fields, lining up from artificial photosynthetic system, molecular spin electronics, catalyst, into solar energy.

2. My Research Area

I participated in this symposium as junior speaker and I had an opportunity to share my research which I have been carried out during my master study in Osaka University. My research is on the area of thin film solar cells and I delivered presentation titled “Electrochemical Deposition of Cu_2O Thin Films for $\text{Cu}_2\text{O}/\text{AZO}$ heterojunction solar cells”. The general idea of my research is to fabricate low-cost thin film solar cells by utilization of electrochemical deposition method. Photovoltaic is one of the most advanced technologies of clean power production from abundant solar energy. However, to make the photovoltaic system truly viable, it must be economically competitive with fossil fuels and other emerging renewable energy technologies. In addition it must be environmentally friendly. Thus, searching for light-absorbing materials which are low cost, abundant, and environmental friendly for long-term sustainability has become one of the main objectives in the photovoltaic research.

I studied Cu_2O as a potential material for low cost photovoltaic absorber. Cu_2O is a p-type semiconductor with bandgap energy in the range of 1.9 – 2.2 eV, which can absorb visible light up to 620 nm. Cu_2O is a mass abundant and economically available material with less-toxicity. I am focusing on verifying the applicability of the electrodeposited Cu_2O as an active p-type absorber

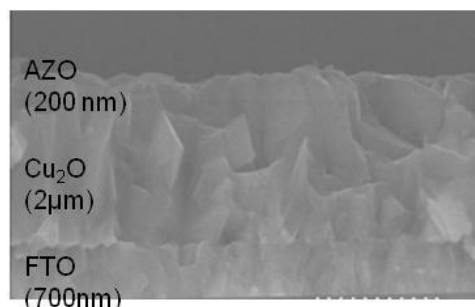


Fig 1. Cross-sectional Scanning Electron Microscopy (SEM) image of a $\text{Cu}_2\text{O}/\text{AZO}$ solar cell

material in thin-film solar cells, and to optimize its applicability by constructing p-n junction with other n-type materials to realize low-cost solar cell with reasonable efficiency (~10%). In a preliminary study, aluminum-doped zinc oxide (ZnO:Al) was chosen to construct a p-n junction with Cu₂O and succeeded in obtaining the solar cell properties with an energy conversion efficiency of 0.6%.

3. Feedback from The Symposium

I received feedback from Prof. Fukuzumi and Prof. Braunstein regarding my research. Prof. Fukuzumi asked the expected maximum efficiency of my solar cell and Prof. Braunstein asked the stability of the Cu₂O material. These two issues are particularly important when designing solar cell especially for practical applications. The former determines the maximum amount of solar energy can be converted to electricity, and the latter describes the life time and also the reliability of the cell.

4. Overall Impression of the Symposium

Overall, this symposium broadened my knowledge on the state of the art of the chemistry research. As a student and young scientist as well, this symposium helped me developing multidisciplinary way of thinking with its broad topics. As the human problems become more complex, multidisciplinary approach is required to solve those problems. This is where Chemistry as a branch of science has a main role, which encompasses different topics such as environmental, physical, biology, and energy. Various topics delivered by the experts in this symposium, opened new insight to approach problems. This symposium I believe is an integral part in the long term objective of this Global COE program, "Save the earth". Certainly similar symposium in the future will be very much benefiting to the growing of multidisciplinary research involving chemistry, and also bring insight and inspiration to student and young scientist like me.

I would like to thank "Osaka University Global COE program : Global Education and Research Center for Bio-Environmental Chemistry" for this great opportunity.

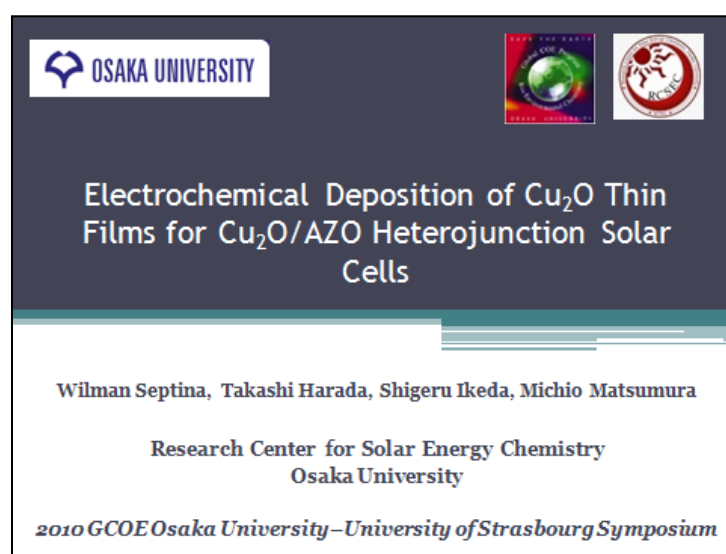


Fig 2. Title slide of my presentation on the symposium.