

Research Topic	Development of high performance organic semiconductor materials for energy conversion devices	Graduate School of Engineering
Host University	National Chiao Tung University / Hsinchu City / Taiwan	Applied Chemistry, Environmental and Biomedical Engineering
Duration	From July 1 to August 30, 2019	YAMADA Yuto

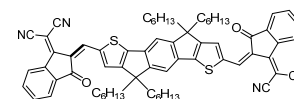
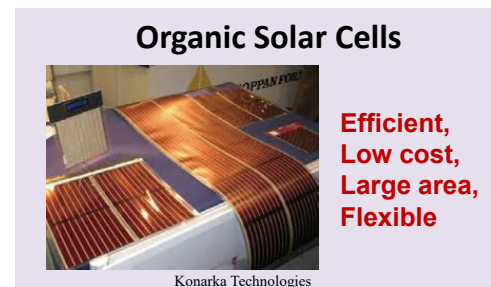
## Summary of the Research Activities

My research topic at OIT is the development of a new film forming method for thermoelectric materials. Professor Shih-Ching Chuang of National Chiao Tung University is mainly focusing on four research topics, that is, research on a conjugate addition of carbonyl to carbon at  $\alpha$ -position, a catalytic reaction using transition metal, an organic solar cell, and fullerene. During this study in Taiwan, I carried out chemical synthesis of new semiconductor material toward the application in organic solar cells.

In organic solar cells, an electron-donor and an electron-acceptor materials are used as two types of organic semiconductors. In particular, it has been reported that an acceptor-donor-acceptor (A-D-A) type acceptor molecule having two electron-deficient units and an electron-rich core exhibits high energy conversion efficiency as an organic molecule (Figure 1).

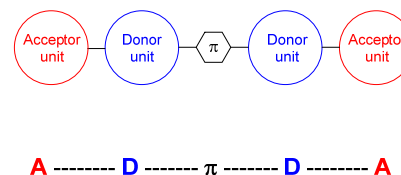
The final target molecule during in my study is the compound shown in Figure 2. This molecule is an acceptor material, consisting of two acceptor parts and two donor parts in the molecule. To obtain the final compound, multiple synthesis steps are required. First, I synthesized an acceptor unit, a donor unit, and a  $\pi$ -spacer unit, respectively. Next, I tried the reaction to connect each unit to obtain the target molecule.

My research in Taiwan has allowed me to carry out various types of organic reactions. I could learn the skills of modern experiments, which further improved my understanding of organic chemistry. In addition, I was able to learn ideas for designing the molecular structure, taking into account the function of the molecule and the method of synthesis.



Y. Lin, et al., J. Am. Chem. Soc. 2016, 138, 2973.

**Figure 1.** Structure of an acceptor-donor-acceptor type molecule.



**Figure 2.** Structure of the target molecule.



## College Life

National Chiao Tung University is located in Hsinchu City, Taiwan. There are many faculty research buildings on campus, with facilities such as a library, dormitories, restaurants, a gym and pools. I felt that I could get almost everything I needed on campus. I stayed in a student dormitory where graduate students live. I was staying in one of the four rooms. They were very kind to me. So I was able to spend a fulfilling time in Taiwan.



## 指導教員講評

今回の台湾・国立交通大学への短期留学を通じて、学生自身が主体的に研究を進める能力が身に付いたと評価しています。また、現地の学生と英語で交流することにより、研究者としてだけでなく、人間としても大きく成長したように思います。今後の研究活動の糧とし、よりいっそうの邁進を期待しています。

指導教員氏名: 村田 理尚