RSE-JSPS Scotland-Japan Collaborative Symposium:
Organic Optoelectronics: Lighting Up the Future, 3rd May 2018

On 3rd May 2018, a symposium jointly organized by the Royal Society of Edinburgh (RSE) and the Japan Society for the Promotion of Science (JSPS) London office was held at RSE offices, with over 70 attendees from institutions all over Japan and Scotland. The theme of the event was research advances in organic optoelectronics and the invited talks explored the latest developments in many potential applications.

After the signing of a Letter of Intention between RSE and JSPS London to agree to strengthen co-operation between the two organisations, opening remarks were given by Professor Marian, Scott Vice President of International at RSE and the Director of JSPS London, Professor Nobuo Ueno. Both spoke of there being much synergy of interests and possibilities for collaboration between Scotland and Japan in science in general and in the field of organic optoelectronics in particular. They both expressed their hope for this symposium to be an arena to facilitate these research links especially amongst early career researchers. Further welcomes and introductions to the aims of the symposium were given by the academic Chairs Professor Ifor Samuel from the University of St Andrews and Professor Chihaya Adachi from Kyushu University. This was followed by the first session of presentations that focused on the development of Organic Light-Emitting Diodes (OLEDs). The first speaker was Professor Hironori Kaji from Kyoto University who presented his latest research on highly efficient OLEDs containing recently-developed thermally activated delayed fluorescence (TADF) materials and an explanation of the high-throughput screening method based on theoretical computations and simple experiments used to develop these materials. Professor Kaji also presented a multiscale charge transport simulation developed in his lab that has successfully reproduced experimental charge carrier mobilities in amorphous organic thin films without using any adjustable parameters. The second speaker, Dr Eli Zysman-Colman, from the University of St Andrews, explained about his recent progress towards emitter design, particularly targeting blue emission and presented the first examples of organic TADF emitters in light-emitting electrochemical cells. The final speaker of this first session was Dr Ko Inada from Kyushu University who explained about his current work on investigating molecular stability through the calculation of Bond Dissociation Energy (BDE) based on Density Functional Theory (DFT) and the degradation pathways that were identified and confirmed by the experimental data. This session was followed by a coffee break.

The second session of presentations covered organic functional materials and the first speaker was Professor Ifor Samuel who presented a new applications field for organic semiconductors in communications. He explained the desirable properties of organic semiconductors for the emerging field of Visible Light Communication for both transmitters and receivers. The second speaker was Professor Ken Onda from Kyushu University whose presentation focused on several types of time-resolved infrared vibrational spectroscopy systems developed in his lab to study the structural dynamics of OLEDs. The final speaker in this session was Dr Aruna Ivaturi from the University of Strathclyde who reported on the colour and switching properties of dye-sensitised nano crystalline electrochromic devices and their potential industrial and commercial applications. This talk was followed by a thought provoking discussion session led by Professor Ifor Samuel who invited the speakers and audience to consider the next stages of development for their field; what better

methods for calculation and experimentation would be possible and the steps necessary for fabrication of more efficient devices. Lunch followed during which time the group photo of all attendees below was taken.

In the afternoon, the running theme of presentations was on novel molecules for organic electronic devices and their characterisation. The first presentation was given by Professor Peter Skabara from the University of Glasgow. He outlined his work on the synthesis and properties of monodisperse conjugated star-shaped and linear structured oligomers and their application in photonic and electronic devices. The next presentation was given by Professor Hiroyoshi Naito from Osaka Prefecture University who presented his latest studies on the characterization of transport properties of working organic semiconducting devices using impedance spectroscopy. The final speaker of this session was Dr Emily Draper from the University of Glasgow. She explained her current research on the properties and structure of Perylene Bisimides, a self-assembled small molecule, and its potential use for organic electronic devices. A coffee break followed before the final set of presentations starting with Professor Chihaya Adachi. He presented his work on developing organic semiconductor laser diodes and device architectures, highlighting the recent success of his lab in realizing quasi-Continuous Wave lasing by engineering both singlet and triplet excited states and discussed the possibility of electrical pumping. The next presentation came from Professor Neil Robertson of the University of Edinburgh who spoke about his work on a range of new triarylamine-based hole-transport materials for perovskite solar cells (PSC) as alternatives to spiro-OMeTAD. Professor Robertson explained about their thermal, optical and electrochemical properties and how the study of these materials in PSCs has led to trends arising from the tuning of redox potential and the tuning of alkyl-chain substituents. The final presentation of the symposium was given by Dr Katsuaki Suzuki from Kyoto University. He presented his recent research on the design and synthesis of triarylboron-based TADF emitters that show high external quantum efficiencies in OLEDs and the results of a solid-state Nuclear Magnetic Resonance (NMR) spectroscopy study of organic semiconducting materials. The audience were engaged throughout, asking searching questions, and the discussions were wide-ranging after each presentation, covering experimental processes and suggestions for development of applications and stimulating a very clear potential for collaboration. Before the symposium was brought to an end Professor Ueno and Mr Ryo Satomura, International Programme Associate from JSPS London, presented an overview of JSPS activities and international funding programmes on an individual, group and institutional level, encouraging attendees of the symposium to use these funding opportunities to facilitate collaborations between each other. The symposium was brought to a close with remarks from Professor Samuel who summed up the success of the day. He commented on the illuminating talks that had covered many facets of optoelectronics and organic semiconductors which through discussion had generated exciting ideas for displays, lasers, lighting and communication and powering them as well as experiments and computation for the next stages of development. All attendees were then invited to join a reception and poster presentation session and to use this time to build on the success of the day's symposium by continuing discussions and networking.

Comments from the organisers:

"I was impressed very much by the scientific and technological discussions during this fantastic joint symposium organized by JSPS London and the Royal Society of Edinburgh. I would particularly like to thank the academic co-chairs, Professors Adachi and Samuel, and all the guest speakers for taking

the time to thoroughly explain about their exciting research. I therefore believe that many of the participants could learn new possibilities for organic optoelectronic devices through the presentations and discussions that took place and as a result we can expect more efficient research collaboration between Japan and Scotland in the near future. Ultimately, the impact of this symposium was to show that organic optoelectronics can illuminate the way we need to move forward in terms of future energy conservation in the world."
Professor Nobuo Ueno, Director, JSPS London

"There was always a lively buzz of conversation during the day and it was clear that there was a great deal of discussion taking place both following the presentations and in the breaks. As well as very distinguished scientists there was also a good number of early career researchers present and so the lasting impression was that the future of collaborations between Scotland and Japan is very bright."
Professor Ethel Marian Scott, Vice President, International, Royal Society of Edinburgh.

"It was a fascinating day showing so many aspects of the science of organic semiconductors and their applications. I was very pleased to see the lively discussions throughout the day, suggesting there is great potential to develop Scotland-Japan co-operation in this field."
Professor Ifor Samuel, University of St Andrews.

"During the past 30 years, there has been significant progress in organic electronics and photonics research. Now we would like to pioneer the next generation of science and technology through intense collaboration between Scotland and Japan. This symposium provided a good chance to unify our efforts."
Professor Chihaya Adachi, Kyushu University

The signing of a Letter of Intention between Professor Marian Scott, RSE and Professor Nobuo Ueno, JSPS London

Symposium Chairs Professor Chihaya Adachi and Professor Ifor Samuel

Symposium Attendees