Institution: University of Sheffield

Unit of Assessment: 9 – Physics

Title of case study: Economic success of spin-out company Ossila Ltd

1. Summary of the impact

The company Ossila Ltd has developed a range of products targeted at developers of organic electronic devices, with products based on know-how derived from research within the Soft Matter Physics (SMP) group in the Department of Physics and Astronomy. The company also supplies research-based services to technical markets around the world. Since its establishment in 2010, the company has grown organically, and now has a growing revenue stream that makes it a sustainable profit-making entity, with 85% of its products sold to overseas markets. The company enjoys rapid growth and currently employs 10 people (~7 FTE equivalent). Ossila's financial turn-over has increased by between 50-100% annually, [text removed for publication].

2. Underpinning research

Carbon-based (organic) semiconductors have been the subject of intense study for around twenty years, as they offer the prospect of enabling the development of consumer electronics, ranging from colourful, flexible displays, to printed electronics. The Soft Matter Physics (SMP) group has a long track record of fundamental studies on organic semiconductors and has built significant knowledge based on their fabrication, testing and optimisation.

The research underpinning the establishment of Ossila is based on work by Professor David Lidzey and colleagues on the development and optimisation of organic photovoltaic (OPV) and organic light-emitting devices (OLED). In particular, EPSRC-funded research addressed the optimisation of OLED devices based on semiconducting polymers. The motivation for this study was to create a miniature, high-speed OLED device that could be used as the basis of an organic laser-diode. As part of this work, a structure was developed based on a glass sheet covered by a series of indium tin oxide (anode) [ITO] pixels. When coated with a semiconducting polymer film and a series of metal contacts, the device emitted efficient electroluminescence at very high brightness **[R1]**. Using a pulsed drive scheme, it was shown that such devices could act as communication elements by emitting high-repetition rate optical pulses **[R2, R3]**. The work on the development of an OLED device fabrication system, together with device encapsulation methods, was an important component of the first series of products supplied by Ossila.

The development of organic electronic devices based on new combinations of organic semiconductors has been an area in which Sheffield has a long track record **[R4]**. Subsequent work at Sheffield explored the fabrication and optimisation of OPV devices **[R5, R6]**, based on a series of polymeric materials. The necessary understanding and optimisation of the requirements used to process these materials into efficient OPV and OLED devices that were developed during this research helped guide the first semiconductor materials set commercialised by Ossila.

3. References to the research [* = References that best indicate the quality of the research]

R1 Wilkinson, C.I., Lidzey, D.G., Palilis, L.C., Fletcher, R.B., Martin, S.J., Wang, X.H., Bradley, D.D.C. (2001) Enhanced performance of pulse driven small area polyfluorene light emitting diodes. *Applied Physics Letters,* **79,** 171-3. doi: 10.1063/1.1383799

R2* Barlow, I.A., Kreouzis, T., Lidzey, D.G. (2007). A polymer light-emitting diode as an optical communication light source. *Organic Electronics,* **8**, 621-4. doi: 10.1016/j.orgel.2007.04.003

R3* Barlow, I.A., Kreouzis, T., Lidzey, D.G. (2009). High-speed electroluminescence modulation

of a conjugated-polymer light emitting diode. *Applied Physics Letters*, **94**, 243301. doi: 10.1063/1.3147208

R4* Virgili, T., Lidzey, D.G., Bradley, D.D.C. (2000). Efficient energy transfer from blue to red in tetraphenylporphyrin-doped poly(9,9-dioctylfluorene) light-emitting diodes. *Advanced Materials,* **12**, 58-62. doi: 10.1002/(SICI)1521-4095(200001)12:1<58::AID-ADMA58>3.0.CO;2-E

R5 Kingsley, J.W., Green, A., Lidzey, D.G. (27 August 2009). Fabrication and optimization of P3HT:PCBM organic photovoltaic devices. SPIE 7416, *Organic Photovoltaics,* X, 74160T, doi:10.1117/12.829178. doi: 0.1117/12.829178

R6 Yi, H.N., Johnson, R.G., Iraqi, A., Mohamad, D., Royce, R., Lidzey, D.G. (2008). Narrow Energy Gap Polymers with Absorptions up to 1200 nm and their Photovoltaic Properties. *Macromolecular Rapid Communications,* **29**, 1804-9. doi: 10.1002/marc.200800440

4. Details of the impact

Summary

The impact of the research is primarily economic, and can be judged in terms of the income generated and the jobs created. This has been achieved through the establishment (in 2010) of the company Ossila Ltd **[S1]**. Ossila provides a catalogue of materials, components and consumable items to researchers working on the development of organic electronic devices **[S4]**, and mainly exports its products to foreign markets (40 countries in total, worldwide). The breakdown of sales per area in 2012 were: UK 15%, EU 36%, US 8%, rest of world 41% (including India, China, Brazil, Korea, Japan, Mexico, Canada, Singapore, Malaysia) **[S3]**. Ossila also undertakes contract research projects for other companies and has helped such companies to apply for further funding.

In the three years of trading to 2012–13, Ossila has had a total turnover of [text removed for publication], with all profits deriving from sales having been re-invested in the company. [text removed for publication] **[S2, S3]**. Ossila currently employs ten part-time and full-time workers (~7 people at full time equivalent). In total, the company has offered over 131 man-months of employment at technical, graduate and post-graduate level.

Development of the company [S4]

Ossila was founded in 2010 by Professor David Lidzey, Dr Alastair Buckley, and Dr James Kingsley, working at the University of Sheffield. The initial investment to found Ossila and to purchase stock was made by a director's loan. The majority of Ossila's sales are through the company website. The first products developed by Ossila were based on the technical know-how of its founders. These were based on a patterned ITO electrode, connector-device and encapsulation system.

Since then, the range of products sold by Ossila has expanded significantly. The company now sells a range of laboratory consumable items, electronics and other testing equipment to researchers working in organic electronics. In 75% of cases, the products supplied by Ossila are designed in-house, with the company playing a direct role in their manufacture.

Ossila also sells a range of organic semiconductor materials that each come with a full-process recipe that allows the user to fabricate high-efficiency OPV/OLED devices. Ossila commissions the synthesis of many of the organic semiconductors that it sells. Other materials are produced by partner companies and are then re-sold by Ossila; however, considerable value is added through testing material performance, performing quality control and developing processing protocols that are supplied to customers.

Joint testing

Ossila undertakes contract device development with other companies engaged in organic electronics research. This has enabled such companies to explore the development of new, innovative products that has enabled them to make investment decisions that are underpinned by experimental data.

Employment

Ossila is based on the North Campus Nanotechnology site at Sheffield University. The company has created 7 FTE science-based jobs in a region of the country that has suffered economic decline due to a historical dependence on heavy industry.

Wider impact

Ossila has produced further impact by making the research and development of its customers more effective. It has sold products to over 200 research groups worldwide, including to many of the world's top Universities, with this research helping to drive the commercialisation of organic electronics.

5. Sources to corroborate the impact

S1 Companies House (company registration number is 06920105).

S2 Inland Revenue VAT data and EC sales list. (VAT Number GB 978 2092 81)

S3 A letter on file from the Managing Director of Ossila Ltd confirms the commercial details quoted.

S4 www.ossila.com