

Short Report for JSPS London Website

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The 4-month JSPS Short-term Fellowship provided me with an opportunity to collaborate with AIST in Japan to fabricate high-efficiency thin film silicon solar cells.

Thin film silicon solar cells have a semiconductor layer with thickness in the order of 100 nm – about ten times thinner than the current crystalline silicon solar cells. However, a thinner silicon layer is also more transparent to the incident light especially in the long-wavelength, near-bandgap region. As solar cells rely on converting the incident light into electricity, an increased transparency to the incident light reduces the device efficiency. So my main research challenge was to develop an effective nanoscale solution to ‘trap’ the incident light in the thin semiconductor layer and reduce any optical and electrical losses which may arise due to the escaping of useful light.

My approach in particular, focused on using electron-beam lithography to fabricate random arrays of silver nanodiscs near a silver mirror, which was later integrated as the back-contact of a microcrystalline silicon solar cell deposited at AIST. The nanodisc-mirror structure was optimised to exhibit low surface roughness and significant light-scattering in the near-bandgap region of thin film solar cells. This collaborative research yielded successful results with the nanostructure-based device exhibiting higher efficiencies and higher photocurrent when compared to conventional thin film solar cells without the nanostructures.

Although my stay at AIST was only 4 months, I got a chance to experience the highly-disciplined and enthusiastic research culture in Japan. My research colleagues at AIST were very polite and helpful. Tsukuba, the hometown of AIST, houses leading research institutes in every field ranging from robotics to telecommunications to photovoltaics! In fact, some of these institutes also organise regular exhibits for visitors, with displays of their recent exciting research projects. For instance, I particularly found the robotics exhibit in AIST a unique opportunity to learn something outside my particular field of research.

Tsukuba also offers its visitors an opportunity to hike on Mt. Tsukuba, enjoy the sight of beautiful cherry blossoms during Spring (very refreshing!) and experience the comfort of travelling on the Tsukuba Express – a very convenient Japanese railway line which connects to Akihabara (the town well known for electronics, which is just a few minutes from Tokyo Station) and the nearby areas in less than an hour! For those interested in travelling around, I would highly recommend learning Japanese before you arrive in Japan. The Japanese people really appreciate it if you manage to

understand and communicate in their language, even if it is just knowing simple phrases such as 'Good Morning' and 'Thank-You'.

Finally, I would like to thank JSPS for this unique opportunity which has helped me experience and thoroughly enjoy both, the research culture and the rich traditional culture that Japan has to offer!