

Position Description

Position Title: Postdoctoral – PV Cell Recycling 2020

Position Number: New

Classification: Postdoctoral Researcher, Academic Level A (A6) or Level B (B1), Full Time, duration 2 years

Faculty/PAVE Centre/Organisational Unit: FSET / Fluid and Process Dynamics (FPD) Group

Department: Mechanical and Product Design Engineering

Project Title

Electrically-Enhanced Recycling and Refining of End-of-Life Silicon Photovoltaic Cells – Process Upscale

Position Purpose

A Postdoctoral researcher position (Level A6/B1, Full time/1.0 FTE, 2 years duration) is available for a suitable candidate to undertake the project on “Electrically-Enhanced Recycling and Refining of End-of-Life Silicon Photovoltaic Cells – Process Upscale”. The successful applicant will carry out the research project closely with Swinburne Researchers, CSIRO (Commonwealth Scientific and Industrial Research Organisation, Australia) and related industry partners.

There is a genuine worldwide problem of a growing generation of WEEE (waste electrical and electronic equipment), i.e. about 40 million tonnes per year. WEEE contains of more than 40 elements including the strategic metals and hazardous elements. The concentrations of the strategic metals in the WEEE are higher compared to that of in their respective underground ores. This makes them suitable as secondary metals sources. End-of-Life (EOL) Photovoltaic (PV) cell is also considered as WEEE. Considering the average panel lifetime of 25 years, the global solar PV waste is anticipated to be between 4-14% of total generation capacity by 2030 and rise to over 80% (~78 million tonnes) by 2050. In addition to the Si, EOL PV cell contain very valuable Ag which is used as metallisation pastes/inks in the cell. There is also a problem of Si kerf (slurry) waste generated from manufacturing process of PV Cell (account for up to 45% loss of ultrapure materials), totalling to approximately 160,000 tonnes/year (and increasing if not processed).

This project is part of a broader project to develop a unique pyrometallurgical process that allows high volume and high throughput recycling and processing of end-of-life (EoL) Si Photovoltaic (PV)-cells and alternative silicon source (e.g. Si kerf). The process involves the application of voltage through electrodes placed across molten silicon and slag phases during slag refining reactions. This results in the removal of impurities (such as Boron (B) and Phosphorus (P)) at much faster rates and higher amounts compared to the regular slag refining or current Si production process; and at the same time promotes maximum recovery of high value Silver (Ag) from EOL-PV, making the overall recycling process economically attractive.

This proposed project will design, develop and demonstrate a pilot scale process of electrically-enhanced silicon refining process for recycling and processing of EoL-PV Cell and alternative Si sources. The project, in particular, will:

- 1) Collaborate with other existing sub-projects to develop a model that relates the applied voltage with the equilibrium partition ratio
- 2) Establish the optimum process parameters for the pilot scale
- 3) Test different materials for electrodes; establish design and cell configurations for the pilot scale
- 4) Test the pilot scale process
- 5) Develop process flowsheet and process pathways for the next stage

This position will work with a high degree of autonomy and as such is expected to demonstrate initiative and responsibility in achieving the positions goals and pursuing research directions in the project under the leadership of the Lead Chief Investigator.

The position is for 2 years full time equivalent, fixed term. The academic level of the appointment (A or B) will depend on the years of postdoctoral experience. The salary level of Academic A6-B1 is \$87,603 - \$98,744 + 17% superannuation

Location

The research will be carried out at Swburne University of Technology (Hawthorn, Melbourne, Australia) and CSIRO (Clayton, Melbourne, Australia). The successful applicant may spend time at both locations (30 minutes apart) to carry out the project. The successful applicant may need to travel to present research finding to the funding body, at conferences, or visit industry collaborators.

Key Responsibility Areas

<p>Research</p>	<ul style="list-style-type: none"> • Carry out research in the project according to its research plan. • Planning and execution of relevant research work and data analyses, including modelling, survey and experimental study relevant to the project. • Work towards broader project objectives; ensuring close liason with supervisors • Contribute to broader research activities and output of the Group with support and guidance, both individually and as a member of a team. • Maintain a high-quality record of regular and original research publications of high international standing including peer reviewed journal papers. • Present and demonstrate research results at project workshops, seminars and conferences.
<p>Project Management</p>	<ul style="list-style-type: none"> • Coordinate projects, including the development of project plans, project completion and the implementation of project outcomes. • Assist in the identification, negotiation and management of project resource requirements. • Undertake research, analysis, report writing and publishing • Provide support to management of the relevant Laboratories
<p>Research Students Supervision</p>	<ul style="list-style-type: none"> • Provide supports, advice to and co-supervise postgraduate students, honours students and/or visiting students in the appointee's area of expertise.
<p>Swinburne Behaviours</p>	<p>Commitment to the Swinburne Behaviours of:</p> <ul style="list-style-type: none"> • Communicate – Say it – have the conversation, respect each other’s differences, give meaningful feedback and share honestly and openly • Listen and Learn – Hear it, learn from it – learn from one another, actively listen to each other, resolve conflict and be innovative • Collaborate – Share it – work constructively together with a common purpose to achieve the university’s goals • Trust – Trust it – be open to and with others, act with fairness and respect, inspire positive expectations and communicate effectively • Act – Do it – have a strong sense of immediacy, take practical action and see it through
<p>Other</p>	<ul style="list-style-type: none"> • Undertake Group, Department-wide and/or university-wide responsibilities as required.

Key Selection Criteria

Candidates are required to respond to each of the selection criteria below

Key Selection Criteria	Essential / preferable	
Qualifications	<ul style="list-style-type: none"> • Doctoral qualification (or research experience) in Materials Science/Engineering, Mechanical/Manufacturing Engineering, Chemical Engineering, Metallurgical Engineering or related areas. 	Essential
Experience/ Knowledge/Attributes	<ul style="list-style-type: none"> • A thorough knowledge of thermodynamic/kinetics modelling and hands-on experience with thermodynamic / thermochemical packages 	Essential
	<ul style="list-style-type: none"> • A hands-on experience in high temperature experimentations (kinetics and equilibrium) 	Essential
	<ul style="list-style-type: none"> • Ability to design and conduct independent research projects within a broader overall team environment, to identify complementary expertise and initiate appropriate collaborations, and to analyse the state of areas of technology from publications and patents 	Essential
	<ul style="list-style-type: none"> • Demonstrated high standard of interpersonal and communication skills including the ability to work both independently and collaboratively in a multi-disciplinary environment 	Essential
	<ul style="list-style-type: none"> • Proficient interpersonal and communication skills, including the ability to work within a diverse team 	Essential
	<ul style="list-style-type: none"> • Demonstrated capacity to supervise research postgraduate students 	Preferable
	<ul style="list-style-type: none"> • Experience in electrochemistry 	Preferable
	<ul style="list-style-type: none"> • Industrial experience in a process/metals industry 	Preferable
	<ul style="list-style-type: none"> • Track record of high-quality journal publications 	Preferable

Further information and how to apply

Please submit expression of interest (EOI) for this position to Professor Akbar Rhamdhani (ARhamdhani@swin.edu.au) by using email subject "EOI-Swinburne Postdoctoral – PV Cell Recycling". Please include a copy of your CV, academic degrees, and copies of journal publications (if applicable).

The deadline for the EOI is **31 August 2020**.

For further information about the position, please contact Professor Akbar Rhamdhani at ARhamdhani@swin.edu.au.

Relevant weblinks:

Swinburne

FPD Research Group

Application Process

CSIRO

<https://www.swinburne.edu.au/>

<http://www.swinburne.edu.au/science-engineering-technology/research/fluid-and-process-dynamics/>

<https://www.swinburne.edu.au/courses/applying/how-to-apply-research-degree/>

<https://www.csiro.au/>