SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

Title: ***Halide perovskite thermoelectric materials***

Description:

Thermoelectric materials generate a voltage from a temperature gradient. Thermoelectric generators made from these materials can recover waste heat and convert it into electrical power. These devices have potential for powering small electronic devices, and in the future a thermoelectric generator placed on someone's skin could even generate electricity from their body heat to power a wireless medical sensor. However, significant materials challenges still need to be overcome in order to obtain high thermoelectric figure of merit (ZT) materials and efficient devices.

One promising new class of thermoelectric materials are the halide perovskites. These materials have been studied extensively for photovoltaics, and it is known that they have low thermal conductivity and high charge mobility – both of which are important for thermoelectrics.

This project will focus on development of halide perovskite materials for thermoelectric applications. There will be a particular emphasis on (i) controlled electrical doping, and (ii) structural optimisation by bottom-up nanostructuring.

2. Project Scope

Research project objectives:

1. *Synthesis of highly conductive halide perovskites.*
2. *Develop protocols for controlled electrical doping of halide perovskites.*
3. *Characterisation of reduced dimension 2D, 1D and "0D" perovskites for thermoelectrics.*

3. Desired Skills from the Student

- Experience in any of:
  - Materials characterisation.
  - Thin film deposition.
  - Electrical testing.
  - Semiconductor devices.
  - Halide perovskite materials.
  - Thermoelectric materials.
- The ability to work in a laboratory environment.
- Qualifications in any of: Materials Science, Physics, Physical Chemistry.

4. Supervisors

Primary supervisor: Dr Oliver Fenwick (School of Engineering and Materials Science)

Secondary supervisor: Dr Joe Briscoe (School of Engineering and Materials Science)