Supplement A

Key Aims

KA 1. Improve the cycle life performance of EC devices.
KA 2. Improve the mass specific energy density of EC devices.
KA 3. Improve the mass specific power density of EC devices.

Primary Objectives

PO 1. Review state-of-the-art scientific literature relating to this field.
PO 2. Establish sound hypotheses for which the scientific method can be applied.
PO 3. Establish experimental configurations and procedures which will enable these hypotheses to be tested.
PO 4. Acquire appropriate experimental materials.
PO 5. Characterise experimental materials.
PO 6. Conduct experiments which test the hypotheses at hand.

Secondary Objectives

SO 1. Replicate, where possible, techniques used at the industrial scale as opposed to the laboratory scale.
SO 2. Develop advanced research technique or methods which can aid research in this field.

Research Aims (defined post literature review)

RA 1. To develop and quantify an EDLC type EC device which possesses a stable high voltage ESPW through the use of capacitance balancing. Specifically, the aim is to achieve the proper capacitance balancing using material asymmetry at each electrode. Such a device should subsequently be assessed for improvements in capacitance if a material with high microporosity is used at the positive electrode.
RA 2. To develop and quantify an LIC type EC device which possesses a novel silicon based negative electrode. Such a device should also be compared against current state-of-the-art LICs which utilise graphite based negative electrodes.

RA 3. To utilise spray deposition in producing multi-layer electrode coatings. This should take the form of both coatings in which each layer is of the same material composition and coatings in which the material composition of each layer differs through the inclusion of conductive additives.

RA 4. To produce or acquire electrodes suitable for use in EDLC and LIC type EC devices. The production of electrodes is to be attempted by both tape casting and spray deposition; both methods should be optimised and assessed with the aim of producing durable and consistent coatings.

RA 5. Electrode coatings (in their final form) should possess thicknesses between 100 and 200 μm and the active material mass of a single electrode is to be greater than 10 mg.

RA 6. To use materials and techniques (except those under investigation) which are closely related to current industrial standards. This aim has been included to maximise comparability under common research practices and with commercial devices.

RA 7. To incorporate a QRE device into the coin cell containment method. This should provide the possibility for directly measuring (or inferring) the potential of both positive and negative electrodes while minimising possible interference with cell performance.