**Supplementary materials**

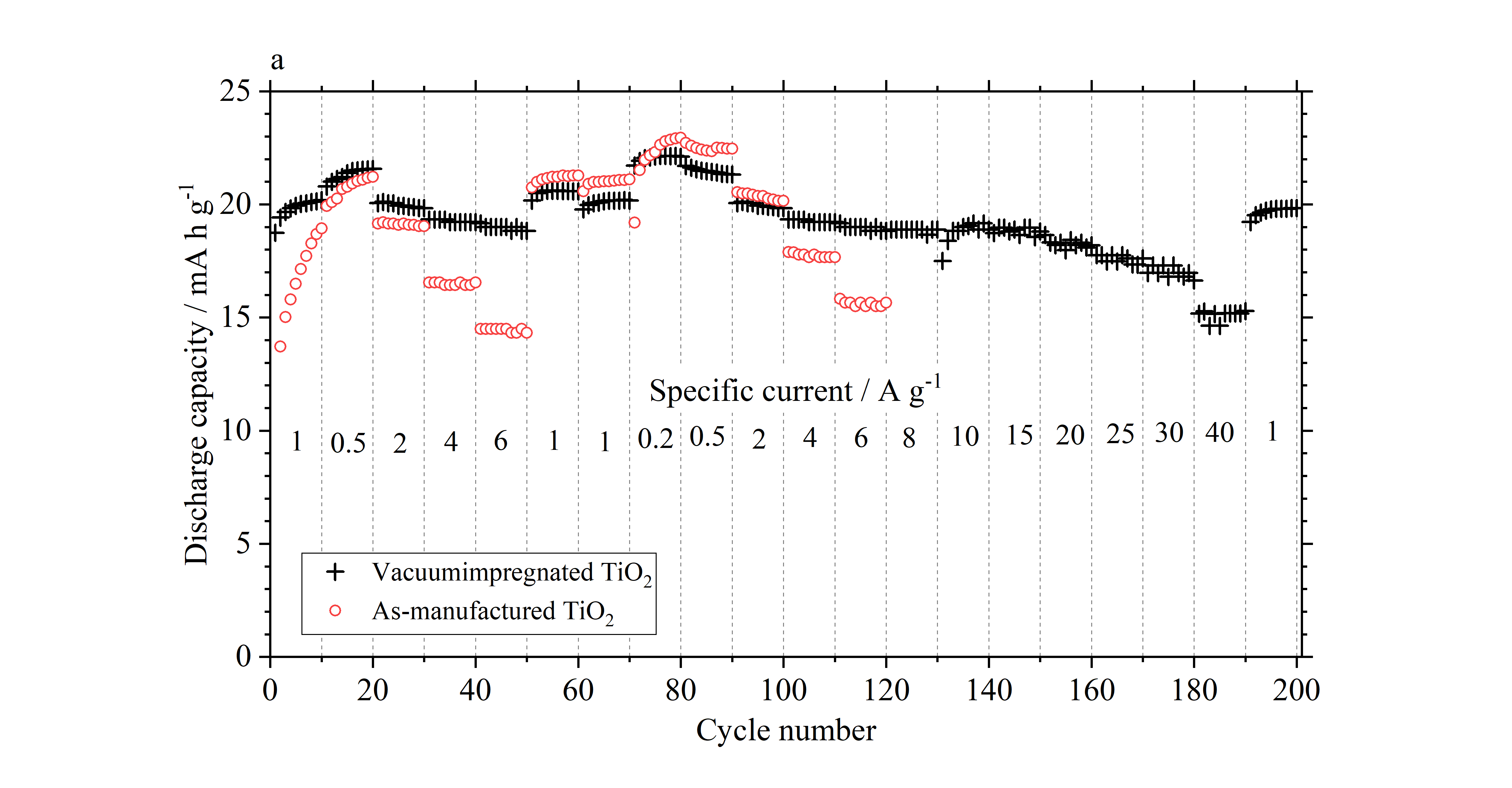
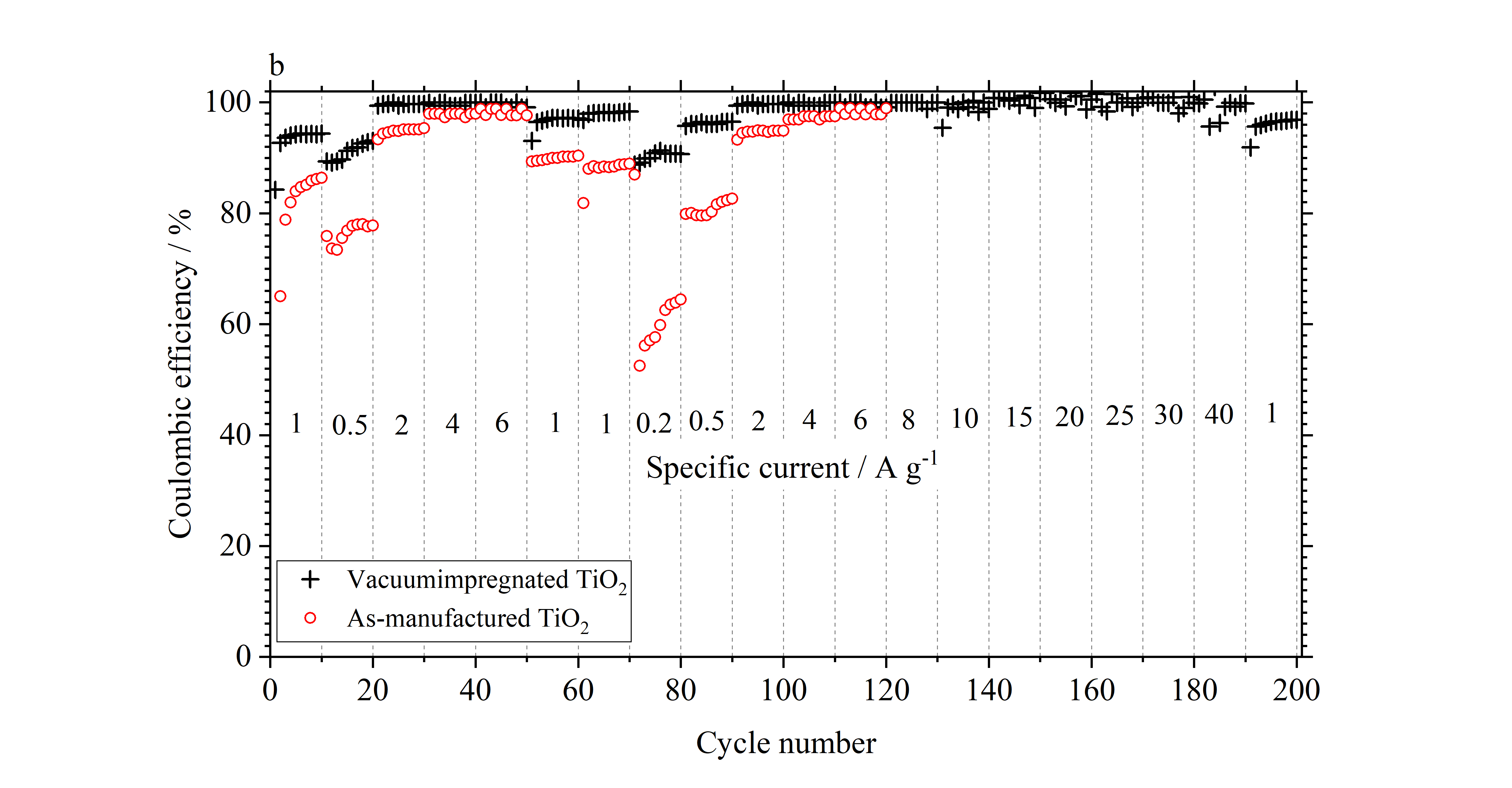
**Electrochemical study of TiO2 in aqueous AlCl3 electrolyte and vacuum impregnation for superior high-rate electrode performance**

A.W. Holland, A. Cruden, Aysen Zerey, Andrew Hector and R.G.A. Wills

**Table S1.** Material and performance overview of selected high power aqueous devices using a combination of capacitive, psuedocapacitive and battery electrodes.

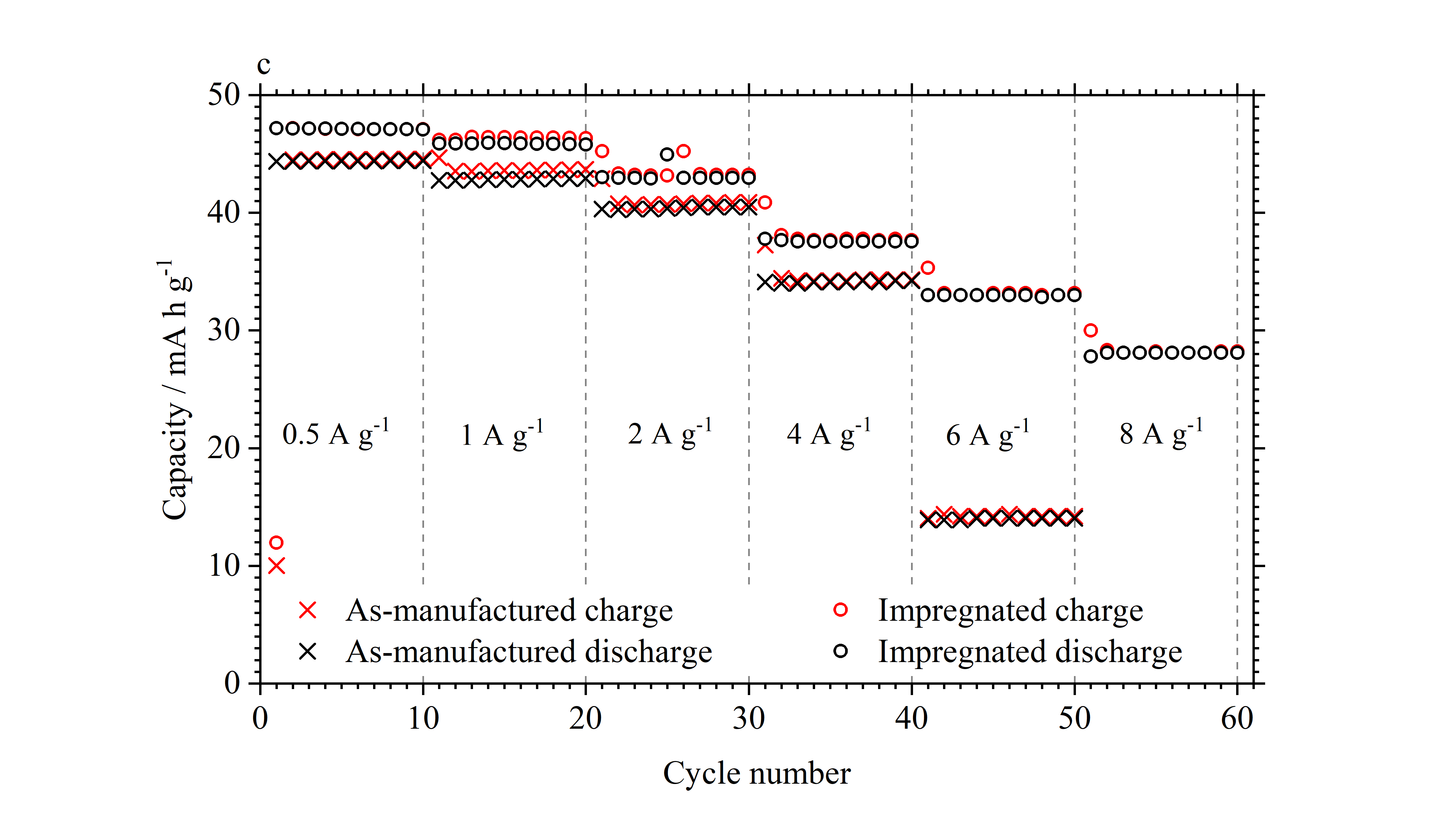
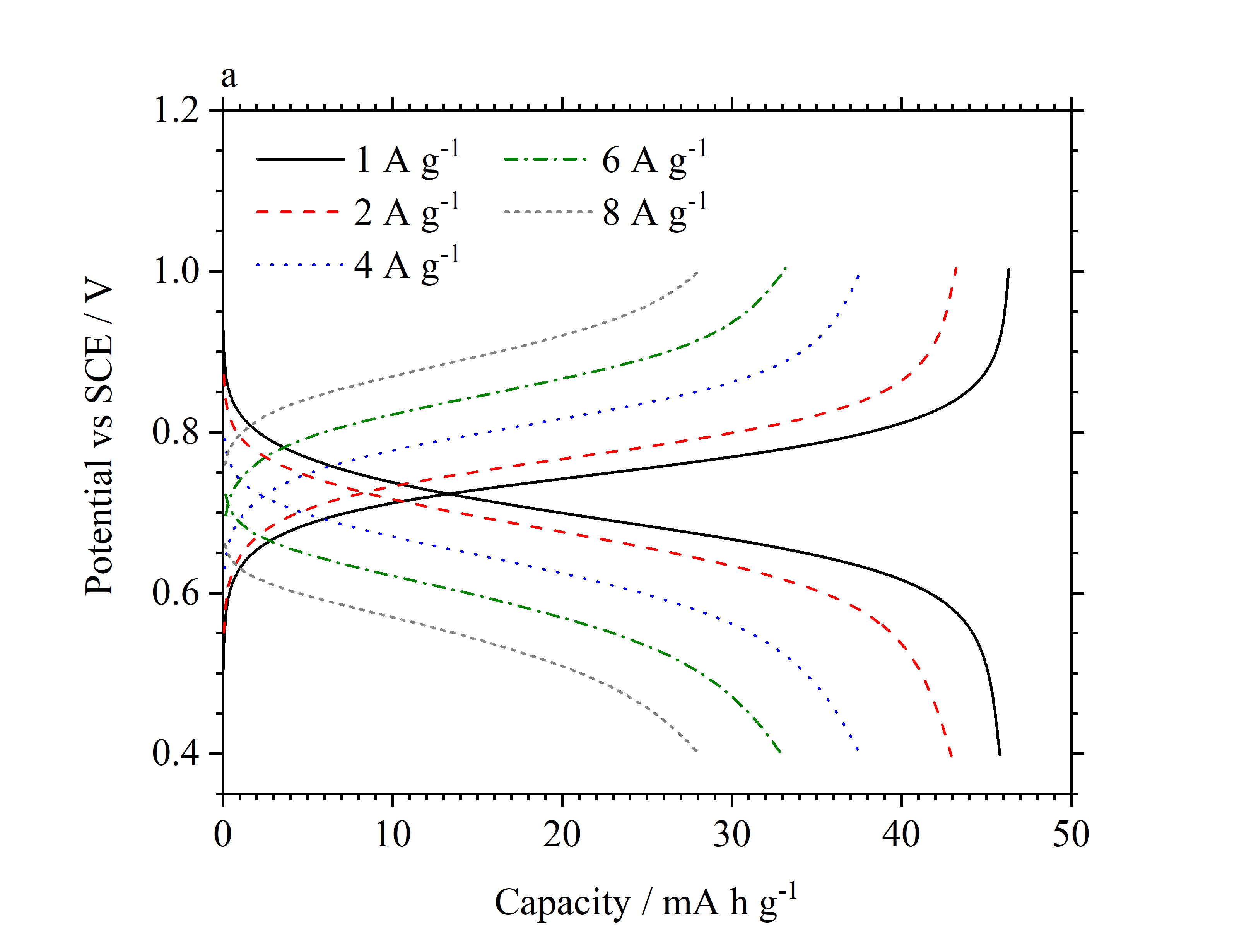
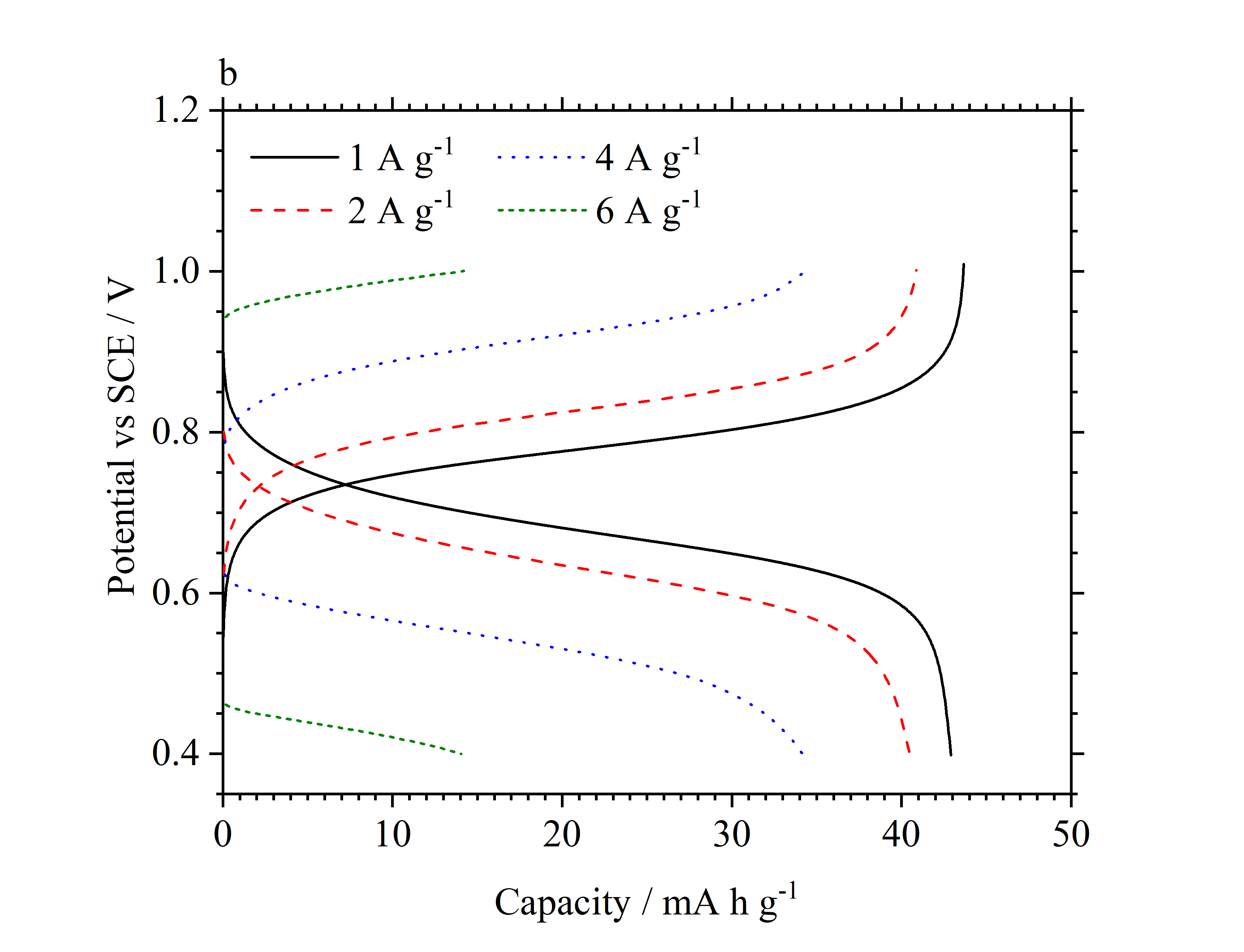
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| **Paper** | **Electrode materials (negative//positive)** | **Electrolyte** | **Voltage range** | **Energy at max power** | **Energy at min power** |
| Menzel et al, ***Prog. Nat. Sci*., 25,** 2015 [1] | AC//AC | KI/Mg(NO3)2 pH9 | 0 V – 1.8 V (linear) | 10 Wh kg-1 at 3 kW kg-1 | 30 Wh kg-1 at 0.2 kW kg-1 |
| Zhou et al, ***RSC Adv, 6*,** 2016 [2] | AC//PB | Na2SO4 | 0 V – 1.8 V (linear to 1V with sharp increase after) | 10 Wh kg-1 at 0.4 kW kg-1 | 10 Wh kg-1 at 1.2 kW kg-1 |
| Fic et al, ***Electro. Acta, 206*,** 2016 [3] | AC//AC | LiNO3/KOH | - | 15 Wh kg-1 at 10 kW kg-1 | 20 Wh kg-1 at 0.1 kW kg-1 |
| Lu et al, ***J. Mater. Chem. A*, *3****,* 2015 [4] | Fe3O4-rGO//MnHCF | 0.5 M Na2SO4 | 0 V – 1.8 V (approx. linear) | 28 Wh kg-1 at 2.2 kW kg-1 | 43 Wh kg-1 at 0.27 kW kg-1 |
| Zhao et al, ***ACS AMI, 6*,** 2014 [5] | rGO//CoHCF | 0.5 M Na2SO4 | 0 V – 2 V (curved without distinct plateau) | 6.7 Wh kg-1 at 25 kW kg-1 | 34 Wh kg-1 at 2.4 kW kg-1 |
| Hanna et al, ***JPS, 354*,** 2017 [6] | AC//LiMn2O4 | 2M Li2SO4 | 0.5 V – 1.8 V (approx.. linear) | - | 14 Wh kg-1 |
| Pasta et al, ***Nat. Comms, 5*,** 2014 [7] | MnHCF//CuHCF | 10M NaClO4 | 0.5 V – 1.3 V (faradaic S-curve) | 15 Wh kg-1 at 0.693 kW kg-1 | 27 Wh kg-1 at 0.027 kW kg-1 |
| Yu et al, ***Ceramic. Int, 43*,** 2017 [8] | NaTi2(PO4)3// Na2/3Ni1/4Mn3/4O2 | 1M Na2SO4/1M Li2SO4 | 0.6 V – 1.7 V (plateaus present) | 16.5 Wh kg-1 at 0.798 kW kg-1 | 36 Wh kg-1 at 0.016 W kg-1 |

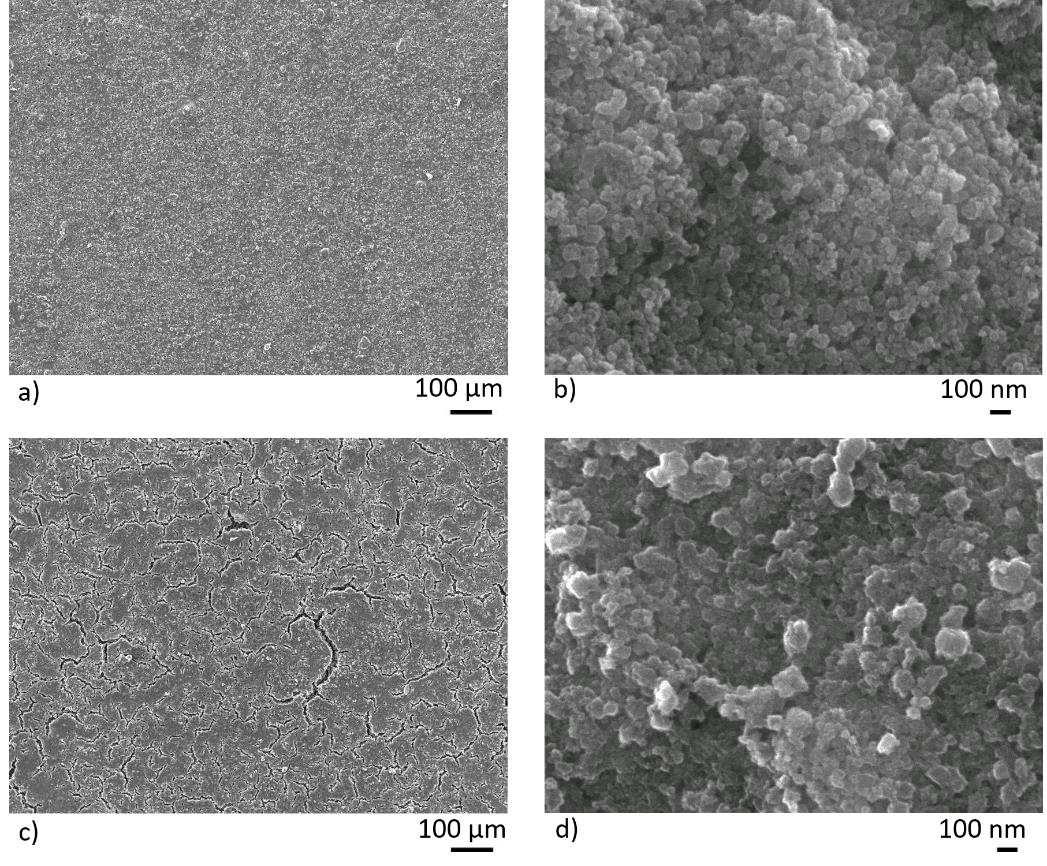
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| ***…continued***  **Paper** | **Electrode materials (negative//positive)** | **Electrolyte** | **Voltage range** | **Energy at max power** | **Energy at min power** |
| Kumar et al, ***Electro. Acta, 220*,** 2016 [9] | MnO2//MnO2 | 1M Na2SO4 | 0 V – 1 V (linear discharge) | 8 Wh kg-1 at 3.6 kW kg-1 | 39 Wh kg-1 at 0.32 kW kg-1 |
| Zhang et al, ***ACS AMI, 9*,** 2017 | AC//SiO2@TiO2 | 1M KOH | 0 V – 1.5 V (triangular with curve) | 14.9 Wh kg-1 at 3 kW kg-1 | 29 Wh kg-1 at 0.375 kW kg-1 |
| Abbas et al, ***JPS*, 326,** 2016 [10] | AC//AC | KI/Li2SO4 | - | 16.2 Wh kg-1 at 1.7 kW kg-1 | 26 Wh kg-1 at 0.075 kW kg-1 |
| Mostazo-Lopez et al, ***Int. J. Hydrogen En, 41*,** 2016 [11] | Doped-C//doped-C | 1M H2SO4 | 0V – 1.2 V (linear) | 3.5 Wh kg-1 at 10 kW kg-1 | 10 Wh kg-1 at 0.1 kW kg-1 |
| Pazhamalai et al, ***J. Ind. Eng. Chem, 64*,** 2018 [12] | Graphene//MnHCF | LiNO3/KOH | 0 V – 2 V (approx. linear) | 31 Wh kg-1 at 3.2 kW kg-1 | 44 Wh kg-1 at 0.59 kW kg-1 |
| Liu et al, ***Electro. Acta, 188*,** 2016 [13] | Graphene-Ni//Cu1.79Co0.21CH | 6M KOH | 0 V – 1.6 V (curve on charge) | 7.1 Wh kg-1 at 4 kW kg-1 | 21.5 Wh kg-1 0.2 kW kg-1 |
| Peng at al, ***ACS Sust. Chem. Eng, 5*,** 2017 [14] | Doped-C//NiSe-MoSe2 | 2M KOH | 0 V – 1.6 V (curved) | 19.6 Wh kg-1 at 8.6 kW kg-1 | 32.6 Wh kg-1 at 0.415 kW kg-1‑ |
| Peng et al, ***JPS, 297*,** 2015 [15] | Co0.85Se//doped-C | 2M KOH | 0 V – 1.6 V (slight curve) | 13.2 Wh kg-1 at 7.5 kW kg-1 | 21.1 Wh kg-1 at 0.4 kW kg-1 |
|  |  |  |  |  |  |

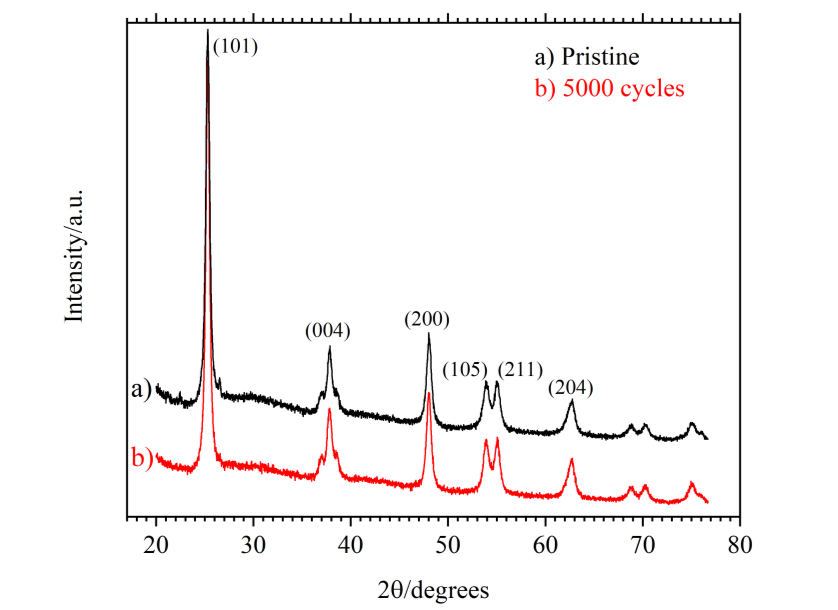


**Figure S1.** Capacity and coulombic efficiency vs cycle number for a vacuum (a) and non-vacuum (b) impregnated electrode cycled between +0.4 V to -1.0 V vs SCE in 1 mol dm-3 AlCl3/1 mol dm-3 KCl.

**Figure S2.** Voltage profiles of vacuum impregnated CuHCF (a) and as-manufactured CuHCF (b) vs SCE, in 1 mol dm-3 AlCl3/1 mol dm-3 KCl. (c) charge and discharge capacity of the same CuHCF electrodes as a function of cycle number and specific current.



**Figure S3.** SEM images of two 25 nm TiO2 electrodes. (a) and (b) are of a pristine electrode with (c) and (d) taken from an electrode that had undergone 5000 cycles. Top and bottom images are at x100 and x75000 magnification respectively.

**Figure S4.** XRD patterns of two 25 nm TiO2 electrodes: pristine (a) and after 5000 cycles (b) at 2.0 A g-1 in 1 mol dm-3 AlCl3/1 mol dm-3 KCl.

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