Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

High Areal Capacity Electrodes

Enabled by segregated networks of carbon nanotubes

Overview

To meet trends such as the rise of electric vehicles, significant advances in the energy storage capability of batteries are urgently required. Most research has focused on the development of high-capacity electrode materials. This research optimizes electrode architecture to maximize the electrode areal capacity. Above a critical thickness, existing solution processed particulate films have mechanical instabilities (i.e. they can crack) which leads to failure.

We use segregated carbon nanotube membranes are used to increase the maximum thickness of electrodes with increased mechanical stability. This allows for the increase of areal capacitance and, therefore, improves battery energy density.

Advantages

- Increased mechanical properties:
  - Supresses mechanical instabilities
  - Allows the fabrication of electrodes with thicknesses of up to 800 μm
  - Improved stability to repeat charging cycles
- Very high conductivity.
- Fast charge distribution within the electrodes.

- Areal capacities of up to 45 and 30 mAh cm−2 for anodes and cathodes, respectively
- Full cells demonstrated with extremely high areal capacities (29 mAh cm-2) and energy densities (450 Wh kg-1).

- Compatible with current industrial manufacturing process (slurry casting method)
- Applicable to both Li and Na ion batteries
- Charge vs. speed of charge delivery can be tailored depending on application need.

Technology Description

- Extremely thick and high areal capacity battery composite electrodes enabled by the formation of segregated nanotube (CNT) networks

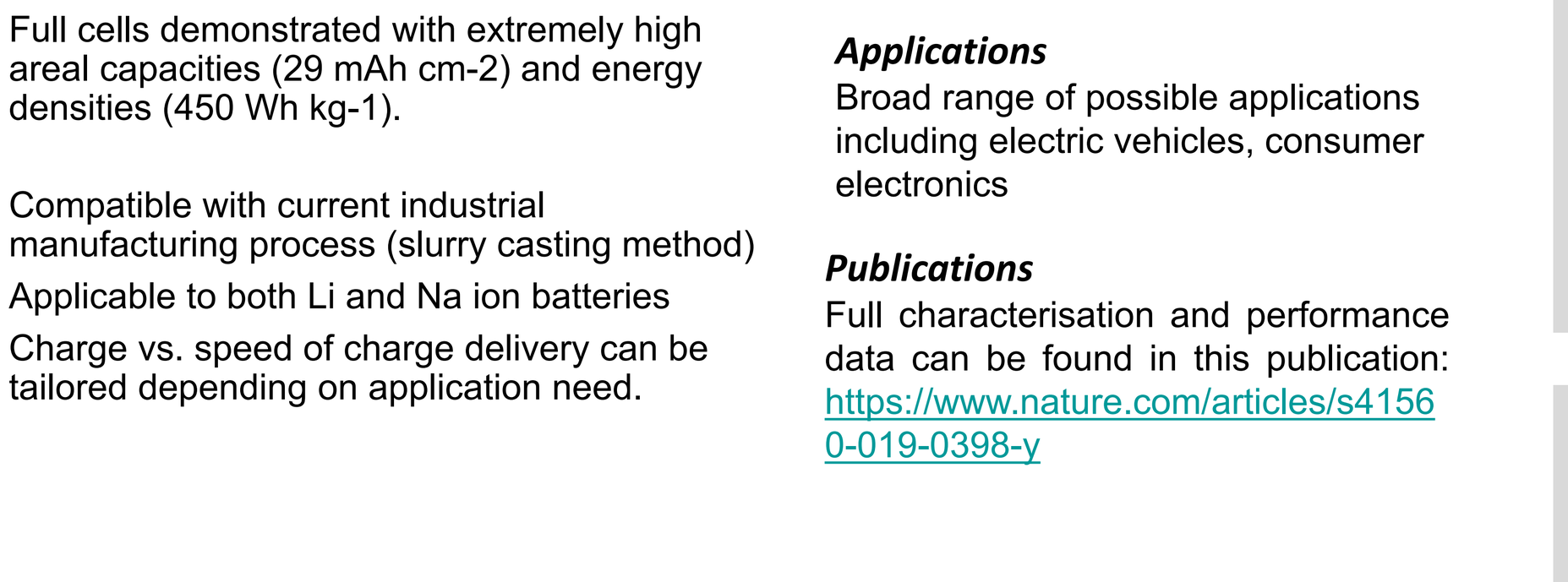
- Simple method to produce both high areal capacity anodes/cathodes from any high-performance materials (e.g. graphene-wrapped silicon nanoparticles and $LiNi_xMn_yCo_zO_2$)

Applications

Broad range of possible applications including electric vehicles, consumer electronics

Publications

Full characterisation and performance data can be found in this publication: https://www.nature.com/articles/s41560-019-0398-y



Technology Sector
Batteries, electric vehicles, consumer electronics etc.

Patent Details
WO2020144298A1

Opportunity
Research collaboration
Available to License

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