

# High Powered Lithium-based Energy Storage Device for Catenary-Free Trams

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Considering the increasing population of the world, a space-efficient transport method is required in which sufficient public transport has a major role. Industries are investing more in electric public transport due to new carbon emission policies. Energy storage devices-based such as lithium batteries, can provide the opportunity for catenary-free public transport, where the need for overhead wires is removed [1-2].

CSIRO Australia in collaboration with the China Railway Rolling Stock Corporation (CRRC) and the Rail Manufacturing Cooperative Research Centre (funded jointly by participating rail organisations and the Australian Federal Government's Business Cooperative Research Centres Program) is prototyping a lithium battery-based device with energy density of 40 Wh/kg and high power capabilities to be used in catenary-free trams. This device while achieving the energy density target at moderate rates (1 C) must also exhibit high power with at least 80% of the energy realized at 20 C charging rates. This is to allow the device to be rapidly charged at the stops along the tram network. Coupled with this requirement, the device must have a low ESR and a long enough cycle life to be useful in the tram application.

The optimized combination of the materials (electrode materials, electrolyte, etc.) are selected after investigation and characterization by methods such as SEM, XRD and by the electrochemical performance tests using coin cells and small scale pouch cells. The cycling performance of these cells are investigated and show stable capacity retention with high energy density close to the target energy and power. The last stage of the work, which is optimizing the scaled-up device to the target specification, is in progress.

## References:

- [1] S. Borén, L. Nurhadi, H. Ny, K-H. Robèrt, G. Broman, L. Trygg, J. Cleaner Production, 140 (2017), 62-71.
- [2] S. Dhar, M. Pathak, P. R. Shukla, J. Cleaner Production, 146 (2017), 139-148.