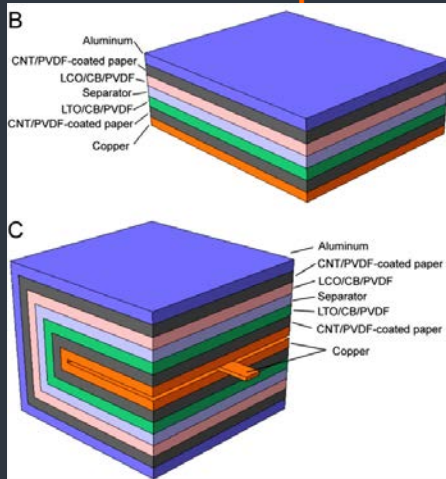
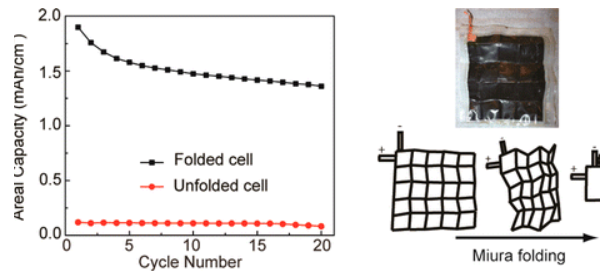


Batteries; Folded Like a Piece of Paper



Initial tests showed that by using a simple folding procedure, the batteries with one fold, two folds, and three folds had approximately 1.9, 4.7, and 10.6 times the areal capacity compared to a planar battery. The Coulombic efficiencies for the folded cells were also higher than for the unfolded cell. The Miura folding technique, being highly efficient improves power density to 14X. Cells were prepared using Li₄Ti₅O₁₂ and LiCoO₂ powders deposited onto current collectors consisting of paper coated with carbon nanotubes.



Origami Battery

Could the secret to unleashing the electromobility revolution be...origami? Researchers at Arizona State University have shown that paper-folding concepts can be applied to Li-ion batteries to build devices with higher energy densities.

In a paper published in the ACS journal Nano Letters, Qian Cheng and the team described how they built a battery using a paper substrate, and improved its energy density by simply folding the paper. Using a more complex pattern called Miura-ori yielded a 14-fold increase in areal energy density.

The low cost, roll-to-roll fabrication methods, flexibility, and bendability of [paper and textile substrates] are attractive for...devices such as batteries, supercapacitors, nanogenerators, solar cells, and fuel cells.

The researchers used carbon nanotube-coated (CNT) papers as the current collectors and deposited conventional active material layers on top of them. They used Laboratory Kimwipes as substrates because the thin and porous nature of the paper allowed the CNT ink to diffuse easily both inside and outside of the paper.

EV's are Good!

Robert Evans, CEO of Cenex, who ran the trial, said: "Uptake of electric vehicles has been slower than some expected with real and perceived barriers including consumer concern over range anxiety and limited public infrastructure. However this report proves that EVs are extremely viable in daily life. Government and industry players are committed to sustained effort to support what is expected to be a gradual uptake of plug-in vehicles in the market, running in parallel with the increased use of plug-in capability, as a means of offering consumers fuel cost savings and improved environmental performance. The UK national Plugged-in Places Scheme has already helped install over 5,000 public charge points in key areas including business parks, tourist attractions and leisure centres with the scheme being extended as well as being complemented by new national measures."

Electric cars involved in the 27 month trial included the Nissan LEAF, Mitsubishi i-MiEV, smart fortwo electric, Citroen C1 EV'ie and Tata Indica Vista EV. The trial reports are available for download from the Cenex website: www.cenex.co.uk/resources.



UK ULCV EV Trial Concludes:-

Launched in 2008, the ULCV demonstrator programme was the first UK-wide major trial of electric vehicles and involved 349 electric vehicles, which covered over 1.5 million miles and made 270,000 journeys over the course of the assessment.

At the outset of the trial drivers said they did want to compromise their daily routine and commonly stated that the car needed to fit their lives rather than vice versa. However drivers quickly found that the electric cars did not require compromise, with the performance of the new electric cars exceeding their expectations. Over a third of drivers stated that their EV had superior performance to their normal car.

The average trip length during the trial was 5.1 miles and the average daily mileage was 21.4 miles. Little range anxiety was experienced during the trial because the vast majority of drivers kept comfortably within the range of EVs. Three quarters (75 per cent) of daily use consumed less than 50 per cent of the battery capacity.

Origin ChargePoint



I was just looking at power options the other day and discovered a very interesting offer from Origin Energy. Seems they have joined forces with ChargePoint and are offering the installation of a Level 2 – 7kW – 30Amp J1772 charge unit into your home garage.

The charging project is associated with Nissan and Tesla. Once you part with your \$2990 you get the following:- The supply and installation of the System including a dedicated 30A circuit (single phase) and a 32A electro-mechanical current circuit breaker

Up to 20 meters of cabling
Up to 5 meters of external cable conduit

Must be installed within 10 meters and in line of sight with existing distribution board
Includes all labeling and testing of the new circuit

Additionally you get an Origin ChargePoint ChargePass allowing charge access at any of the ChargePoint recharging stations throughout Australia.

If you want to go to the next level, a commercial unit allows for coded access and internet monitoring of your charge usage. Cost of this option \$5050.

Molten – Air Battery

Anode	Formula Weight kg mol ⁻¹	e ⁻ s stored	Charge Capacity Ah/kg	d, kg l ⁻¹	E°, V vs O ₂	Energy Capacity gravimetric Wh kg ⁻¹	Energy Capacity volumetric Wh liter ⁻¹
Iron	0.05585	3e ⁻	1,440	7.2	1.0	1,400	10,000
Carbon	0.01201	4e ⁻	8,930	2.1	1.0	8,900	19,000
VB ₂	0.07256	11e ⁻	4,060	5.1	1.3	5,300	27,000

Researchers at George Washington University have demonstrated a new class of high-energy battery, called a "molten-air battery," that has one of the highest storage capacities of any battery type to date. Unlike some other high-energy batteries, the molten-air battery has the advantage of being rechargeable.

Although, at present the molten electrolyte requires high-temperature operation, the battery is so new that the researchers hope that experimenting with different molten compositions and other characteristics will make molten-air batteries strong competitors in electric vehicles and for storing energy for the electric grid.

The battery with the highest energy capacity to date is vanadium boride (VB₂) - that can

store 11 electrons per molecule. However, the VB₂-air battery and many other high-capacity batteries have a serious drawback: they are not rechargeable.

This research has been focusing on iron, carbon, and VB₂ as the molten electrolyte, resulting in very high capacities of 10,000, 19,000, and 27,000 Wh/l, respectively.

Capacities are influenced by the number of electrons that each type of molecule can store: 3 for iron, 4 for carbon, and 11 for VB₂. the Li-air battery has an energy capacity of 6,200 Wh/l, due to its single-electron-per-molecule transfer while a typical Li-Ion battery has a capacity of approx 600 Wh/l, that makes a molten air cell up to 45X higher. Not Bad!!

The Shape Of Things to Come!!



BMW i3 Electric Li-Air

At the recent launch of the BMW i3 lithium-ion battery-electric car, BMW board member Ian Robertson said that in the next three to four years there will be more progress in battery development than in the previous 100 years. He said electric cars will have batteries with twice the current power within four to five years, which will double the range. Toyota Motor Corp and BMW AG have agreed to jointly research a lithium-air battery. Lithium-air battery has its anode filled with lithium, and cathode with air. Lithium metal-air batteries can store more than 5,000 watt-hours per kilogram more than another class of energy-storage devices including fuel cells (see previous article). Given the recent news that General Motors is working on an EV that can go 200 miles (320 km) per charge at a cost of about \$30,000 to compete with Tesla's as yet unnamed 200 mile \$30,000 EV due in approximately three to four years, the 2016/17 model year promises to be a very exciting year for affordable, long range electric vehicles.



This Month's Technology Review

A new Vacuum pump system from EVSOURCE! This unit is possibly the quietest on the market at 50dB at 300mm, other pumps can be as much as 90dB @ 300mm. This kit includes everything you need for a vacuum assisted power brake system in an electric vehicle, or to enhance the performance of braking systems in internal combustion vehicles.

The kit comes with all the components needed for a complete vacuum assist solution. This includes an ultra-quiet pump, reservoir, automatic shutoff switch, relay, fuse, and tubing. A reservoir is required to supply backup but if this unit is as quiet as stated it would be worth a look at US\$358.88 (without reservoir).