Polymer batteries for next-generation electronics

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(PhysOrg.com) -- University of Leeds scientists have invented a new type of polymer gel that can be used to manufacture cheaper lithium batteries without compromising performance.

The technology, developed by Professor Ian Ward FRS, a Research Professor of Physics at the University of Leeds, has been licensed to the American company Polystor Energy Corporation, which is conducting trials to commercialise cells for portable consumer electronics.

Professor Ward believes the new material could replace the liquid electrolytes currently used in rechargeable lithium cells. Furthermore, the gel can be made into a thin, flexible film via a fully automated process that is fast, efficient and low cost.

Rechargeable lithium-ion batteries are now the power of choice for a

wide range of portable consumer electronics such as laptops, digital cameras, mobile phones and MP3 players.

Traditional lithium-ion batteries are based on cells (sealed containers) which contain a porous polymer film separator plus liquid chemical filler. This allows lithium ions carrying charge to flow between the two electrodes and also acts as a barrier, holding the electrodes apart to prevent short-circuiting.

The polymer gel developed by Professor Ward and his team removes the need for this separator. They have also developed a patented manufacturing process called extrusion/lamination which sandwiches the gel between an anode and cathode at high speed (10m per minute) to create a highly-conductive strip that is just nanometres thick.

The resultant polymer gel film can be cut to any size and permits a fully-automated process which is cost effective and safe. The lamination process also seals the electrodes together so that there is no excess flammable solvent and liquid electrolyte.

"The polymer gel looks like a solid film, but it actually contains about 70% liquid electrolyte" said Professor Ward. "It's made using the same principles as making a jelly: you add lots of hot water to 'gelatine' - in this case there is a polymer and electrolyte mix - and as it cools it sets to form a solid but flexible mass".

As well as being safe and damage tolerant, the flexible cells can be shaped and bent to fit the geometries of virtually any device.

Provided by University of Leeds