Lithium ion batteries introduction

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In collaboration with a global network of scientists and safety professionals, we define the safe and sustainable use of things ranging from legacy materials to new and emerging technologies. Our discoveries support the development of practical standards and policies by UL Standards & Engagement. Together, we are advancing safety science for the greater good.

Photo: Lithium-ion batteries power all kinds of "mobile" technology, from electric toothbrushes and tablet computers to electric cars and trucks.Photo by Dennis Schroeder courtesy of NREL (photo id#119047).

Artwork: Ordinary batteries, such as zinc-carbon and alkaline ones, cannot be recharged because the chemical reactions that generate the power are not reversible. Once they"re empty of electrical energy, there"s no easy way to refill them.

Photo: A lithium-ion battery, such as this one from a smartphone, is made from a numberof power-producing units called cells. Each cell produces about 3–4 volts, so this battery (rated at 3.85 volts) has just one cell, whereas a laptop battery that produces 10–16 volts typically needs three to four cells.

Unlike simpler batteries, lithium-ion ones have built inelectronic controllers that regulatehow they charge and discharge. They prevent the overcharging and overheating thatcan cause lithium-ion batteries to explode in some circumstances.

Photo: Lithium-ion batteries are less toxic thanbatteries containing heavy metals such as lead, cadmium, and mercury, but recycling them is still farpreferable to incinerating them or sending them to landfill.This photo shows a chemical reclamation process called relithiation,which restores spent battery chemicals to a form good enough to reusewith minimal investment of energy. Photo by Werner Slocum courtesy of NREL (US National Renewable Energy Laboratory). NREL photo id#140317.

Photo: Lithium-ion batteries can inflate like little cushions if they don"t have a means of venting any gases

produced during charging (mainly carbon monoxide, carbon dioxide, and hydrogen, though smaller amounts of other organic gases may also be present). Here are two identical batteries from a cellphone, the top one of which has almost doubled in width due to the trapped gases inside.

Photo: What happens when a lithium-ion battery fails completely. Top: An intact battery. Bottom: An identical battery that failed after being punctured in a lab safety test. Photo by Dennis Schroeder courtesy of NREL (US National Renewable Energy Laboratory). NREL photo id#119819.

Phone: A typical lithium-ion cellphone battery. This one is rated 3Wh, so you"d needabout 25,000 of these to store as much electrical energy as you"d pack into a 75kWh (75,000Wh) Tesla Model 3 car battery!