



The LiForever™ direct recycling process sets a new sustainability standard by keeping active battery materials in their original form, avoiding the creation of black mass — something only 24M® can do. In tandem with the 24M SemiSolid™ battery manufacturing platform and compatible with all battery chemistries, LiForever enables the reuse of nearly every part of the battery cell (up to 98%), making end-of-life only the beginning.

For a better energy future, a better battery is only part of the solution. What happens after a battery reaches the end of its life determines whether the technology is truly sustainable. Until now, conventional cell recycling has been challenging, costly, and harmful to the environment. Toxic processes generate black mass waste, which damages the battery and makes it impossible to extract more than a mere fraction of usable materials.

Unique to the 24M SemiSolid battery manufacturing platform, LiForever is a direct material recycling methodology for EV and ESS batteries that enables the reuse of nearly every part of the battery cell without the expensive and environmentally challenging processes of conventional cell recycling. LiForever keeps active materials in their original form and does not create a black mass — something no one else in the industry can do.

Conventional lithium-ion cells use expensive and toxic pyrometallurgical and hydrometallurgical recycling processes that form black mass e-waste, which damages the structure of the anode and cathode materials. Because of this damage and the process' high cost, less expensive materials like LFP are typically not recycled. Only more expensive metals (most commonly nickel, manganese and cobalt) are extracted from the black mass in their base metal form and reintroduced to the active material production process.

By contrast, LiForever keeps the active materials in their original form and does not create a black mass. This enables the low-cost recycling of all active materials from the anode (graphite) and cathode (NMC, LFP, NCA, etc.). After recovery, the active materials undergo a low-cost cleaning re-lithiation if needed to reclaim their original capacity.

24M LiForever Recycling Technology

Direct Material Recycling Process

