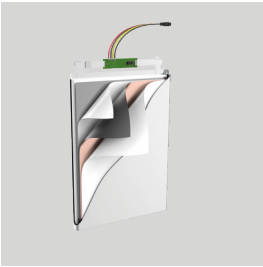
Battery solutions

Surface-finishing solutions for PET foils

General Metal Finishing | Product portfolio | atotech.com

An innovative approach to current collectors



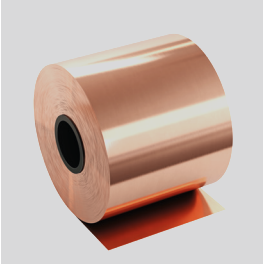


Figure 1: Battery current collectors with separators

Figure 2: Cathode current collector PET foil plated with copper

Plastic-copper composite foils for more efficient batteries

In lithium-ion batteries, current collectors provide mechanical properties like stability to the cell stack. Under the given challenging conditions, they must exhibit chemical and electro-chemical durability. By providing the required characteristics, copper and aluminum foils are the standard materials used. Aluminum may not be used as an anode current collector since lithium forms an alloy with it at a given potential. As all battery cell components are under close examination for their weight-reducing potential and the current collectors account for 15 percent of the battery cell's total weight, foils produced from the heavier copper need to become thinner but still need to provide mechanical stability to the battery cell. Replacing the current collector's core with a plastic carrier foil covered with copper layers is an alternative solution that can facilitate the necessary weight reduction.

Increasing battery cell safety with the new current collector technology

Utilizing the core plastic foil as the carrier for both copper and aluminum current collectors can potentially prevent thermal runways in the event of mechanical damage to the collector foil. The usual occurring short circuit leads to uncontrolled current flow and overheating. In the event of heat, the plastic material melts and insulates the damage from the proceeding current flow, thus also stopping the uncontrolled current flow. The melting characteristics of the plastic foil also inhibit fire trespassing to adjacent battery cells and prevent thermal runaway.

Composition of metalized plastic carrier foils	Atotech processes for foil metallization
STEP 1 Copper PVD seed sputtering with thickness limited due to process restraints	
STEP 2 Enforcement of the thin PVD layer by copper electroplating achieving required thickness of 1 µm, conductivity and stability	**Atotech CuFoil PET copper plating processes**
STEP 3 Protection layers to maintain functionality	**Atotech Cr(VI)-free anti-tarnish solutions: Argalin® XL, Superdip Cu 1000**

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Electrolytic surface finishing solution for copper enhancement on PET foils

Specially developed for the copper plating of PET foils, Atotech **CuFoil PET** copper plating processes provide the desired thickness of <1 µm and ensure an optimal thickness distribution over large areas in reel-to-reel production. They operate at necessary low current densities, avoiding any burning of the thin PVD copper layer.

Three additive systems that are individually analyzable easily regulate the processes. They control mechanical properties such as strength and elongation. When installing our oxidation-reduction auxiliary equipment, which decreases the number of chemical side reactions and controls the copper replenishment, chemical consumption can be reduced.

Features and benefits

- Achieve desired thicknesses of the copper layers
- Provide satisfactory mechanical properties
- Operate at necessary low current densities
- Avoid any burning of thin PVD copper layers
- Ensure optimal thickness distribution over large areas in reel-to-reel production
- Capable of high throughput
- Offer high-quality copper layers

Cr(VI)-free anti-tarnish solutions for the corrosion protection of copper layers

After or during production, while transportation or storage, the active copper surface plated on plastic or as a thin copper foil is prone to oxidation. Corrosion and aging processes directly interfere with conductivity and affect the mechanical properties of the copper layer. Conventional methods preventing oxidation use hexavalent chromium-based dipping processes that passivate the copper surface.

Hexavalent chromium is under the scope to be banned from usage by the REACH regulation due to causing harm to the health of workers. Our Atotech team of experts has developed Cr(VI)-free anti-tarnish solutions based on REACH and RoHs-conform compounds that provide passivation layers for copper preventing metal oxidation. We offer the right combinations of the final metal layer and the anti-tarnish to deliver the required reliability of the finished product.

Argalin® XL: The sustainable, Cr(VI)-free, water-based solution can operate at high speed in high current densities with short exposition times showing high performance in high throughput. The electrolytic passivation process deposits a nano chromium layer from a Cr(III)-containing electrolyte. Various parameters can influence the layer thickness according to the specific customer requirement.

Superdip Cu 1000: The organic component-based solution used as a dip is adjustable to short exposition times, which increases its capability for high throughputs.

Features and benefits

- Provide the best anti-tarnish properties – even after high-temperature exposure
- Offer protection for every level, from process level protection to life cycle protection
- Withstand heat treatment (<140 °C) for 30 minutes with no copper oxide formation
- Withstand exposure to high humidity (90%) and higher temperatures (60 °C) for up to 30 days