ILMC Tool Box Series **2.1**

Battery Production and Recycling

The Various Types of Lead Acid Battery and the Importance of Recycling

1. Lead Acid Batteries

Lead-acid batteries either start or power cars, trucks, buses, boats, trains, rapid mass-transit systems, recreational vehicles and electric wheelchairs all over the globe. The car battery also provides a stable electrical supply to a vehicle's electrical system.

During power outages, lead-acid batteries provide quiet, pollution-free emergency power for critical operations such as air-traffic control towers, hospitals, railroad crossings, military installations, submarines, and weapons systems. In these situations the telephones stay on and this is because every major telephone company in the world, including mobile telephone service providers, uses lead-acid batteries as backup power to the telecommunications systems.

Were it not for standby lead-acid batteries, we probably would have power outages nearly every day because the electric utilities would not be able to handle rapid fluctuations in the demand for electricity. This is when lead-acid batteries come to the rescue, as enormous arrays of batteries delivering large amounts of electricity for short periods of time until additional capacity is added to the grid.

Lead-acid batteries power electric fork trucks used in warehouses, factories, mines, and ships. They also power the shuttle vehicles in airports, as well as wheelchairs, amusement park shuttles and golf carts. On the road, lead-acid batteries power electric law-enforcement vehicles, buses, and very soon mail delivery vans.

2. Why Recycle?

Unless we recycle used batteries certain toxic components pose a potential risk to the environment and human health. However, recycling:

- Saves Natural Resources

By making products from recycled materials instead of virgin materials, we conserve land and reduce the need to mine for more minerals.

- Saves Energy

It takes less energy to make a recycled battery. In fact secondary lead bullion, for example, requires four times less energy to make than primary lead.

- Saves Clean Air and Water

In most cases, making products from recycled materials creates less air pollution and water pollution than making products from virgin materials.

- Saves Landfill Space

When the materials that you recycle go into new products, instead of landfills or incinerators, landfill space is conserved.

- Saves Money and Creates Jobs

The recycling industry and the associated processes create far more jobs than land-fill sites or waste incinerators, and recycling is frequently the least expensive waste management option for cities and towns.

- Recycling Rates

All the components of the modern lead acid battery are recyclable and from an Industry perspective lead-acid batteries are an environmental success story because in the United States just over 96% is recovered and in most of the G7 nations upwards of 95% is recycled. Compared to the usual "flagship" recycled products such as glass bottles at only 38%, aluminum cans at nearly 64% and newsprint at about 68%, lead acid batteries are the clear leaders in the field. In fact, used lead-acid batteries have topped the list of the most highly recycled consumer products for over a decade.

Unfortunately, battery recycling is not a public utility and scrap batteries are only recycled because it is profitable for the secondary non-ferrous industry to do so. In recent years, however, the introduction of essential environmental and occupational health regulations, and an all time low lead price has cut profit margins to such an extent that most secondary lead smelters that are not the beneficiaries of government levies are barely breaking even and others have closed due to severe losses.

It is increasingly important therefore for the secondary lead industry to generate as much income from a spent battery as possible in order to improve margins and maintain profitability.

Although there are some processes that smelt whole batteries most modern secondary plants break spent batteries in a mechanical hammer-mill and gravity separate the components in a series of water filled tanks.

3. Recycling Loop

The earth's resources, no matter how abundant we think they are, are finite, and precious to all of us. It is essential that the food we eat, the water we drink and the air we breathe are free of toxins and keep us healthy. Maintaining a clean environment, re-using and reclaiming resources is a benefits to us all. Moreover, sound environmental management will support sustainable development and growth.

It is therefore in everybody's interest to recycle as much scrap material as possible, especially lead acid batteries, because if they are not recycled the materials in the battery pose a serious environmental problem and a threat to human health.

The ideal loop would be:

- Lead bullion production
- Battery manufacture
- Recovery and recycling of the battery materials

Courtesy of Green Lead

Battery Production and Recycling

The Various Types of Lead Acid Battery and the Importance of Recycling

Lead acid batteries, in whatever form, are all recyclable to a lesser or greater extent. This only means, however, that a battery can be recycled after it is spent. The battery itself does nothing to close the recycling loop if it is not recycled, but you, your governments and your industries can ensure that they enter the loop by creating an infrastructure that will promote and facilitate recycling.

4. Battery Components

In order to ensure that the loop is closed we not only need the right infrastructure, but we also need a battery that is made up of recyclable materials. The modern Lead acid battery is made up of:

A resilient plastic container - usually polyethylene, but increasingly is made from alternative co-polymers or reinforced, but the case material can also be metallic or a synthetic rubber.

Positive and negative internal lead plates - The positive electrode (cathode) typically consists of pure lead dioxide supported on a metallic grid, whereas the negative electrode (anode) consists of a grid of metallic lead alloy con taining various elemental additives that includes one or more of the following and sometimes others not mentioned, antimony, calcium, arsenic, copper, tin, strontium, aluminum, selenium and more recently bismuth and silver. These alloying elements are used to enhance grid strength, corrosion resist ance, reduce over-potential or maintenance, and internal resistance.

Porous synthetic plate separators - increasingly made from rib-reinforced polyethylene, but are also available in PVC and fiberglass.

The plates are immersed in a liquid electrolyte consisting of 35% sulfuric acid and 65% water. It is the electrolyte that facilitates the chemical reactions that enable the storage and discharge of electrical energy and permit the passage of electrons that provide the current flow.

The positive and negative lead terminals used to connect the battery to the car and pass the current from the individual cells via a series of connecting lugs and bridges.

5. Recycling Options

The washed and dried polypropylene pieces (chips) are sent to a plastic recycler, where the chips are melted and extruded to produce plastic pellets for use in the manufacture of battery cases.

Although certain processes will combine the waste lead streams, the most efficient plants feed the paste to the smelting furnace to recover soft lead and the grids and terminals are sent to a melting furnace for the production of hard lead. Lead bullion from both sources will be refined, cast into ingots and sold to the battery manufacturer. The soft lead is suitable for battery paste and the hard lead bullion ideal for grids and terminals.

The Various Types of Lead Acid Battery and the Importance of Recycling

Polyethylene separators can be separated from the polypropylene waste stream and recycled, although in most secondary plants the current practice is to use this waste as a fuel supplement and additional carbon source. It is very bulky material after the separation process and will need to be compacted prior to addition to the furnace.

Used battery acid can be utilized in four ways:

a. Neutralized, and the resulting effluent treated to meet clean water standards and then released into the public sewer system.

b. Reclaimed and after topping up with concentrated acid then used as the elec trolyte in new batteries.

c. Chemically treated and converted to either agricultural fertilizer using ammo nia or to powered sodium sulfate for use in either glass and textile manufac turing or as a filler or stabilizer in household laundry detergent.

d. Converted to gypsum for use in the production of cement or by the construc tion industry in the manufacture of fiberboard.

March 2002