

RECYCLING OF LEAD BATTERY PASTE

New environmentally friendly process

A new process has been developed that has the potential to transform the lead battery recycling industry. The method uses organic reagents (derived from renewable bio-sources) to recycle the lead-bearing paste from waste batteries into a form which can be used directly as the lead oxide precursor for manufacturing new lead battery paste. This method has considerable benefits over the high temperature methods that are conventionally used to recycle lead battery paste into metallic lead.

Key benefits of this process compared to conventional processes include:

- Lower energy requirements
- Lower emissions of toxic gas and dust
- Lower capital equipment cost - the new process can be economic at both large and small scale (>1000tons/yr of lead)
- Tuneable product - the product can be optimised for direct use as the precursor for manufacturing new lead battery paste

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Background

Lead acid batteries are essential for many applications, particularly in the automotive industry. Each year over 4 million tonnes of waste lead battery paste is generated worldwide. Currently lead paste is recovered using high temperature pyro-metallurgical processes which produce metallic lead, along with gaseous and dust emissions that need to be captured and treated.

New recycling technology

A new recycling process has been developed by Dr Kumar of the Department of Materials Science and Metallurgy at the University of Cambridge. Waste lead battery paste (containing a high proportion of lead sulphates) is mixed with carboxylic acids from renewable bio-sources. The output of this leaching step is filtered to produce an organic crystalline lead compound and a sodium sulphate by-product. The organic lead compounds are subjected to a combustion-calcination process at around 350°C. By varying the reaction conditions it is possible to produce either lead oxide (PbO) or a mixture of lead oxide and lead (PbO/Pb) that can be used directly as the precursor for the manufacture of new lead battery paste.

Benefits over conventional processes

New recycling process	Conventional processes (Pyrometallurgical)
Low energy process ~350°C Most energy is provided by the combustion of organic compounds from renewable sources	High energy process~1000°C The energy is normally provided from non-renewable sources such as coal or coke
Lower emissions: Sulphur is converted into an easily removed solid by-product.	Higher emissions: Gaseous and dust emissions require complex pollution treatment control
Low capital equipment cost: Process can be economic at large or small scale (greater than 1,000 tons/year of lead)	High capital equipment cost: Process is only economic at large scale (greater than 30,000 tons/year of lead)
Tuneable product: Pb/PbO product can be used directly for the manufacture of battery paste	Single product: Metallic lead product that requires additional processing for manufacture of lead battery paste.

Figure 1: Flow chart showing the new process for recycling lead battery paste

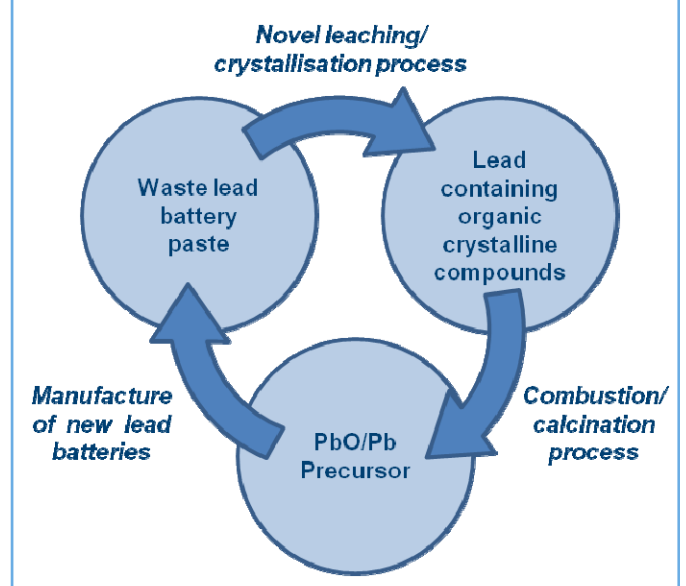
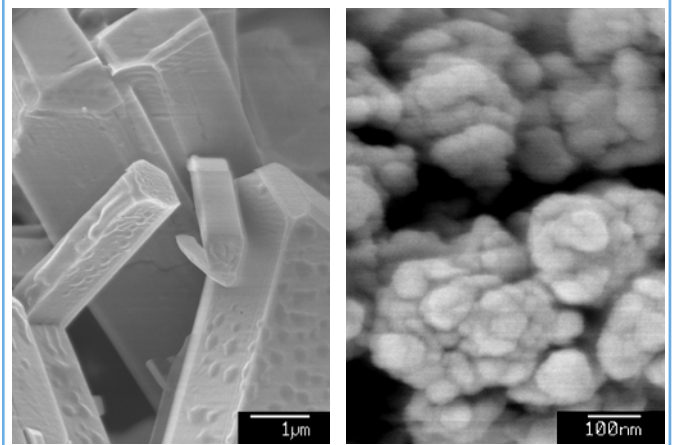


Figure 2: SEM pictures of:

- (a) the organic lead crystalline compound
- (b) the PbO/Pb precursor



Commercialisation

We are seeking commercial partners to develop and commercialise this novel recycling process. The core technology is protected by national patent applications in a number of countries.