

Lead Action **21**

The Evolution of an Element



Plumb the depths of history

The oldest known article to be made of lead is a figurine found in Egypt that dates back to 4,000BC.

Though the naturally occurring element was well known among the ancients, its properties did not lend itself to their immediate needs.

Soft and pliable, it was good for artwork but not as prized as strong iron, shiny copper or the precious metals. Often, it is thought, it was mined as an unwanted by-product of silver as the two were often found in the same place.

However, it found its niche amongst the Romans. When they worked out there was a better way to transport water than strong men, buckets and oxen, its malleability plus its resistance to corrosion made it ideal for their water pipes, aqueducts and tank linings. Lead and lead-rich pewter were also used for kettles, cooking pots and tableware.

Its modern symbol Pb is an abbreviation of its Latin name 'Plumbum' which means 'liquid silver'. It's where the word 'plumber' originated.

The ancient scientists also discovered the properties of brightly coloured lead compounds which were used as early cosmetics, paints and pigments, and lead-rich glazes were popular as the mixture melted easily.

People noticed or at least suspected some harmful effects after long exposure but the metal was considered therapeutic too, and ointments were believed to work better if kept in lead containers.

And so it remained for several hundred years.

The Romans used lead and lead-rich pewter for water pipes, cooking pots and tableware...



Modern times

In the 21st Century lead remains a cornerstone of society, but in a very different way. We understand today that the metal is not suitable for some uses and so lead pipes have been replaced with copper and plastic tubing and medicines are no longer stored in lead receptacles. While its malleability and corrosion resistance are still useful for roof flashings and cladding, lead has moved on with the centuries and harnessing its chemical properties has transformed it into a thoroughly modern metal.

Its incredible density makes it unrivalled for protection from radiation and it is essential to staff working in hospitals, dental surgeries, laboratories and nuclear installations. The cathode ray screens in televisions require leaded glass to protect viewers from potentially harmful radiation. Lead stabilizers are added to PVC plastics to improve durability, and the metal protects thousands of kilometres of underwater power and communications cables. Furthermore, lead acid batteries are at the forefront of storage technologies for Green Energy, such as solar cell and wind turbines. But the majority of lead is used, quite literally, to keep the modern world on the move. Lead acid batteries start cars, trucks, buses and motorbikes and there is currently no viable alternative. More than five million tonnes of lead is used around the world to produce these batteries. Today's lead acid batteries are easily recyclable and not only that, they are close to being 100% recycled.

The fact that used lead acid batteries have a positive economic value ensures the vast majority are collected, either by organised consortia (Sweden and Italy claim up to 100% collection rates) or simply by market forces. Few people are happy throwing away valuable resources. Lead acid traction batteries are also used in electric vehicles such as fork lift trucks and golf carts, and are now integral to both current and planned hybrid vehicles. Furthermore, lead acid batteries are vital as a back-up emergency power supply in cases of mains power failure in hospitals, the emergency services, telephone exchanges, mobile phone networks, and public buildings.

In short, this malleable and dense metal, once favoured for figurines, now powers and protects our modern world.

Not precious but valuable

Given the wide range of industries that exploit the unique properties of lead, it is not surprising that the metal is of significant global economic importance. Lead ores are mined at a rate of more than three million tonnes a year with a market value of around US\$6 billion and the world market for refined lead stands at about US\$15 billion.

Like all elements, lead has unique properties which fit certain specific applications so substitutes are difficult to find and almost always prove significantly more expensive. Currently there are no technically viable alternatives to lead acid battery applications.

Lead batteries store electricity from non-carbon sources...

Over 90% of lead is used in readily recyclable applications...

90%

Use and re-use

While it has a high economic value, lead is relatively economical to produce. As with all metals, there are two production methods. Primary production from mined lead ore is of course the original source of all lead, but secondary production, where it is recovered from recycled products or from residues arising from the production process is of enormous importance. Secondary lead production now accounts for more than half of all lead produced. In the US more than 80% of lead is from secondary production with Europe reporting over 60%. These impressive figures are made possible by the fact that today most lead is used in readily recyclable applications. And unlike many recycled materials, the value of lead means that recycling is economically viable and hence self-sustainable.

This extremely high level of recycling has benefits both to industry and to society at large in respect of economics, energy consumption and resource conservation. Over the years the less recyclable applications of lead, such as paints and fuel additives, have disappeared leaving batteries and lead sheet – both eminently recyclable – as the main products, between them accounting for almost 90% of all lead used.

Safety first

Although the early applications of lead which were of concern to health have been discontinued, lead metal remains a substance which must be handled with care. It was with this in mind that the industry in Europe volunteered in 2000 to conduct a €4 million Risk Assessment. This was the first time an industry had volunteered to conduct such a detailed and comprehensive assessment, and the lead industry spent two years working

with the European Commission and EU governments to establish a process by which regulators could monitor the assessment. The aim was to establish what - if any - risks still existed with reference to the environment as well as public and worker health. Although not yet finalised, the results have proved invaluable in understanding how risks from lead can be effectively managed. And in a few cases, where data appears too sparse to reach firm conclusions, further research has been recommended and industry is committed to completing these additional studies.

The lead industry around the world also proactively adopts new technologies and operating practices to continuously reduce workers' exposure to lead. Governments normally set minimum limits at which workers have to be removed from exposure until their lead levels have fallen to within the acceptable range. For largely historic reasons there is some variation in these limits around the world. Industry's own voluntary lead risk assessment identifies 40 micrograms of lead per decilitre of blood ($\mu\text{g}/\text{dl}$) as a safe level for the future. The risk assessment demonstrates that these levels and indeed much lower levels, can and are being achieved in certain sectors through appropriate workplace management.

The industry recognises that it has a responsibility to encourage best practice wherever lead is produced and lead products used. For this purpose it created and maintains the International Lead Management Centre which responds to requests for assistance to manage exposure risks or introduce battery recycling schemes by providing expert advice to Governments worldwide and in particular to countries in the developing world that do not necessarily have access to the required knowledge or experience.

→ The future

Six thousand years after an ancient Egyptian fashioned a figurine out of 'liquid silver' lead is still very much part of the firmament. Throughout history its uses have evolved and adapted to their time until today it has found its latest niche.

In the 21st Century it is vital and uniquely viable in specific fields, it enables the wheels of industry to turn – as well as those of almost all the vehicles on the planet.

Lead, like all the naturally occurring elements, cannot be destroyed, only recycled – in this case very easily – a fact that is key to the sustainable development of the lead industry in years to come.

Lead – enables the wheels of industry to turn – as well as those of almost every vehicle on the planet.

